2020 USAFRI Research Project Objectives

Inclusion of Alfalfa Hay in Diets for Non-Lactating Dairy Cows During the Prepartum Period
Virginia Polytechnic Institute and State University - Ferreira

Project Award: $91,721

Justification:

- Do you know that alfalfa hay is avoided by dairy nutritionists when formulating diets for non-lactating dairy cows during the prepartum period? Are you aware that alfalfa hay has a negative connotation when speaking about diets for non-lactating dairy cows during the pre-partum period? Generally speaking, alfalfa hay is a "no, no!" when feeding dairy cows in the prepartum period. Further below is an explanation for this. However, before jumping into that explanation, I invite you to answer the following question: "what would the impact be on the alfalfa industry if we change that negative connotation?" According to our estimates, transitioning from a 0% to a 50% use of alfalfa hay in prepartum diets would increase alfalfa hay sales by $45 to $60 million per year.

  Milk fever, also known as clinical hypocalcemia, is a metabolic disease that affects dairy cows in their transition from the non-lactating stage (prepartum) to their lactating stage (postpartum). Under normal circumstances, the concentration of calcium (Ca) in blood is above 8 mg/dL in dairy cattle. In the prepartum period, there is a low requirement for calcium. However, immediately after calving a great proportion of the calcium from blood is secreted in colostrum and milk, bringing down the concentration of calcium in blood. Clinical hypocalcemia occurs when the concentration of calcium in blood drops below 5.5 mg/dL. When this occurs, the cow becomes recumbent, cannot stand, and can even die if not treated immediately. Therefore, clinical hypocalcemia has a major impact on cattle productivity and welfare.

  Feeding acidogenic diets is one nutritional strategy to prevent clinical hypocalcemia in dairy cattle. These acidogenic diets are known for having a negative Dietary Cation-Anion Difference (DCAD), which is the difference between the sum of the cations sodium (Na) and potassium (K) and the sum of the anions chloride (Cl) and sulfur (S).

  Two challenges exist when feeding anionic salts to obtain acidogenic diets. First, there is some data showing that acidogenic diets may depress dry matter intake. In this regard, the study of Oetzel and Barmore (1993) set a precedent after reporting that cows offered anionic salts consumed 23 to 76% less concentrate than cows consuming a diet lacking anionic salts. Because of these results, some dairy nutritionists are reluctant to feed anionic salts to non-lactating cows in the prepartum period or, if they feed anionic salts, they feed them at low doses to ensure that dry matter intake is not depressed. However, there is one flaw in this study, which is that the anionic salts were fed separate from the forages. Hence, cows had the option to avoid the anionic salts. A follow-up question is… would cows still reject the anionic salts if they are included in a total mixed ration? Data from our laboratory (Richardson and Ferreira, 2019) suggest that the answer would likely be "no."

  The second challenge when feeding acidogenic diets is related to the forages included in the diet. When forages contain great concentrations of potassium, as is the case of alfalfa, it is hard to accomplish a negative balance between cations and anions (Ferreira, 2017). However, this is true unless anionic salts are included at high doses. Contrary to this, and as stated above, nutritionists are reluctant to include high doses of anionic salts in diets for non-lactating cows fearing that dry matter intake might decrease. Hence, the best proposed alternative is to avoid the inclusion of alfalfa in diets

for non-lactating cows in the prepartum period.

In a recent study from our laboratory (Richardson and Ferreira, 2019), we fed at a high dose (500 g/day) an anionic salt that contained potassium to non-lactating dairy cattle and observed that dry matter intake was not affected. There are two implications in these observations. First, we can feed anionic salts at high doses without affecting dry matter intake. This is good news! Second, if we can feed anionic salts at high doses, then we could include alfalfa hay in diets for non-lactating cows in the prepartum period. This could become great news!

Therefore, for this project we propose the challenging and risky hypothesis that alfalfa hay can be fed to non-lactating cows in the prepartum period when feeding high doses of anionic salts and that this inclusion of anionic salts does not depress dry matter intake when the anionic salts are included in a pelleted-concentrate that is mixed in a total mixed ration.

Objectives:

- The objectives of this project are to 1) feed different diets to non-lactating cows in their prepartum period; 2) determine dry matter intake during the prepartum period (i.e., 21 days before calving); 3) determine blood Ca concentrations during the prepartum and postpartum (7 days after calving) periods; 4) determine urine pH as an indicator of the effectiveness of the acidogenic diets during the prepartum period (i.e., 21 days before calving); 5) determine Ca output in urine; and 6) perform economic and operative assessments of the utilization of alfalfa hay relative to grass hays.