Response to Reviewer 1 Comments

Point 1: How did you calculate the protein?

Response 1: We calculated crude protein as described on page 4, lines 157-159. *"CP was analyzed by combustion using a CN628 Carbon/Nitrogen Determinator [38]; total N content was multiplied by 6.25, assuming the average N content of proteins is 16% [35]."*

Point 2: Please show the formulas for all studied parameters.

Response 2: The formulas for all studied parameters are described in the methodology section or in the supplemental material. For example, on page 4, lines 184-86, *"RFV was calculated by multiplying digestible dry matter (88.9 - (0.779 * %ADF)) by dry matter intake (120/%NDF) and dividing by 1.29 or the expected digestible dry matter intake for alfalfa [38]."*

Point 3: Why ADF lower in 2019 but not 2018? What was the intrinsic factor that caused the reduction.

Response 3: ADF indicates how digestible the forage is and is cellulose and lignin. ADF is negatively correlated with digestibility. As the plant cell wall matures, lignin accumulates, and ADF increases. ADF in the unfertilized rye treatment was significantly lower than 120 kg N ha^{-1} in 2019 (i.e., based on this alone, fertilizer did not improve forage quality) but significantly higher in the unfertilized treatment than 120 kg N ha^{-1} in 2018 (i.e., based on this alone, fertilizer improved forage quality). In 2018, fertilizing at 120 kg N ha^{-1} significantly decreased lignin compared with no fertilizer, and this is possibly why we also saw a lower ADF with fertilization. However, we did not compare 2018 to 2019 and separated data by growing seasons for all analyses because of differences in weather conditions and field plot locations.

Point 4: How did you estimate the GHGs emission? Program or software used?

Response 4: We used the Farm Energy Analysis Tool as specified in on page 5, lines 247-250, *"We also evaluated the GHG emissions associated with an integrated fertilized rye bioenergy system. **Fertilizer** emissions were modeled in the Farm Energy Analysis Tool (FEAT) [55] as reported in Malone et al. [37] and were separated into fertilizer N_2O emissions and other emissions associated with rye production."* We changed "fertilizer" to "GHG" to be clearer. *"We also evaluated the GHG emissions associated with an integrated fertilized rye bioenergy system. **GHG** emissions were modeled in the Farm Energy Analysis Tool (FEAT) [55] as reported in Malone et al. [37] and were separated into fertilizer N_2O emissions and other emissions associated with rye production."*