Italian ryegrass is highly valued as a high-quality dairy forage. Its popularity has climbed over the years but tapered more recently with the rise in N fertilizer prices. Still, desired for its yield and quality potential especially in cool conditions, it will continue to be considered by dairy farmers. It is especially valued in regions with poorly drained soils where alfalfa struggles. With N applications, it can match alfalfa yield and CP levels and exceed alfalfa in fiber digestibility. However, viability of this is highly dependent on fertilizer prices. Additionally, fertilizer rates may have unintended environmental consequences. While one objective was to evaluate N rate impacts on Italian ryegrass yield and quality, another was to observe economic and environmental impacts of managing it as a replacement for alfalfa in dairy cattle rations. Trials were at the Marshfield Agricultural Research Station (Stratford, WI) from 2020-2022 to explore the potential of Italian ryegrass when cutting frequency and N were managed for high quality goals. Plots were established in early May by planting Italian ryegrass (Allegro, Byron Seeds) at 20 lbs/ac. Soil samples were used to verify P and K levels were adequate. It was treated under 7 different fertilization regimes (sources, rates, application methods) and cut 4-5 times each season. Treatments: no fertilizer, 8,000 gal/ac of surface-applied liquid dairy manure (40 lbs N/ac), urea (46-0-0) broadcast at 30, 60, 90, and 120 lbs/ac, and liquid UAN (32-0-0) applied with a stream bar at 60 lbs N/ac. Fertilizer treatments received the N-rate application for each cutting (5x); manure treatment received applications between each cutting (4x). Total-season N applications ranged 0-600 lbs N/ac/yr. The 3 highest fertilizer rates (60-120 lb N/ac for each harvest) all exceed WI recommendations (UW-Extension Pub. A2809), but do reflect field management to maximize forage yield and protein content. Across 3 seasons, N applications consistently had the greatest impact on yield and CP. The highest N-rates had yield and CP of 3.4 tons DM/ac and 21.8%, respectively, compared to 2.2 tons DM/ac and 15.4% where no N was applied. Differences in other quality parameters including fiber digestibility and relative forage quality were negligible. Yield and CP where manure was the N source were 3.0 tons/ac and 16.4%, respectively; important since even with application cost accounted for, manure is likely the most economical. Since Italian ryegrass forage often coincides with livestock manure availability, it makes sense to determine the feasibility of fertilizer by comparing to manure. At average 2022 fertilizer price, the 2 highest N-rates resulted in production costs ~54 and 72% more than manure, respectively. While the high N rates improved yield and CP, they left behind the most N in soil. N efficiency declined as rates increased, with the 120 lb N-rate utilizing only 37%. Conversely, 30 lbs N/ac applied per cutting had 100% N-efficiency, and manure had 77% – the 2 treatments not exceeding WI recommendations had the best N-efficiency. Additionally, manure treatments resulted in greater season-ending P and K levels, benefitting the overall soil fertility.

Incremental yield improvements (7-20%) and CP (14-32%) for N-rates exceeding WI recommendations do not justify economic (72% increased cost) and environmental (63% of N unused) risk associated with managing Italian ryegrass for maximal protein and yield to replace alfalfa in dairy rations. Instead of viewing it as an alfalfa replacement, it should be viewed as a different crop with unique characteristics for inclusion in dairy cow rations. Research indicates managing Italian ryegrass for optimal yield and quality goals with limited effects on residual soil N can be achieved with either manure or a fertilizer program following University recommendations.