Purpose: The study aimed at assessing the effects of maize-alfalfa intercropping with and without nitrogen fertilization on photosynthetic characteristics, photosynthetic nitrogen utilization efficiency (PNUE) and yield. Methods: A 2-year field experiment with split plot arrangements was conducted to study the effect of different planting patterns (monocropping and intercropping) and N fertilization (N0 and N 225 kg ha-1) on the PNUE of the maize with and without N fertilization in 2018-19. Results: The study findings showed that intercropping under nitrogen fertilizer application increased the yield and dry biomass of the maize crop by 23% and 14% and 25% and 18% respectively in 2018-19. The Land equivalent ratio (LER) was >1, indicating more efficient use of the available resources by intercrops. Furthermore, the leaf chlorophyll, photosynthetic activities and other leaf related traits of maize crop showed an improved efficiency in intercropping when it was practiced with N fertilization, which resulted in a better PNUE as compared to monocropping. Conclusions: The study suggests that intercropping under nitrogen fertilization can improve the leaf photosynthetic activities and PNUE of the maize crop, thereby improving its yield. Therefore, adopting intercropping as an agronomic practice could be crucial for the betterment of the plant, while utilizing the available resources efficiently