Maize (Zea mays L.) grain yield levels and the response to fertilizer nitrogen (N) are expected to change from year to year and location to location. Because yield level and N response have been documented to be independent, and known to influence N demand, optimum N rates at the same location are expected to change each year due to unpredictable changes in the environment. The objective was to further analyze maize grain yield levels and optimum fertilizer N rates from published data in the Central Great Plains of the United States. Optimum N rates were determined by calculating the difference in N uptake between the highest yielding plot and the check plot (no N applied). The difference in grain N uptake between the fertilized and zero-N check plot was then divided by 0.33 (average N use efficiency) to estimate optimum N rate, by site and year. For the 198 site-years of data included, grain yields in both the high N rate, and check (0-N) plots were highly variable. Also, optimum N rates fluctuated from year to year at all locations. Optimum N rates were not highly correlated with the high N rate yield (R2=0.20) or zero-N check yield (R2=0.16). The wide range in optimum N rates observed in all maize experiments suggests the need to adjust N rates by year and location. This is possible using mid-season sensor based technologies that can accurately predict yield potential (expected yield level), and simultaneously encumber N responsiveness known to be independent of yield.

**Keywords** Nitrogen, Optimum N rate, N demand, Maize grain yield