Environmental responses of photosynthesis and CO_2 diffusive conductance as fundamental information for photosynthesis-transpiration coupled model have been increasingly concerned while are still research areas with unanswered questions in cereal crops. Photosynthesis (A), light utilization efficiency (α), mesophyll conductance (g_m) and stomatal coefficient (g_{fac}) in temperate rice and winter wheat were investigated. There were no seasonal trend, no inter- and intra-species differences in relative temperature responses (activation energy ΔH_a) of V_{cmax} or J_{max}. A phenomenon that grain-filling plants generally decreased g_m and had a lower Q_{10} as compared to that at early growth stage existed, particularly in rice. Analyses of environmental influences indicated that optimal temperatures (T_{opt}) in V_{cmax}/J_{max} depended on the prevailing temperature environment. Although prevailing temperature dependence in T_{opt} of g_m was not as profound as that of V_{cmax} or J_{max}, T_{opt} of g_m in winter wheat was significantly lower than rice. Temperature response of R_{dark} in all sampled leaves shared a common trajectory. α were almost invariant, while, high sensitivity to soil desiccation was observed. g_{fac} in sunlit leaves was conservative during wet soil conditions. Shaded leaves with lower N_a had higher g_{fac}, resulting in a negative correlation between N_a and g_{fac} in canopy profiles. g_{fac} was susceptible to fluctuations in soil water potential (ψ_s), rapidly declined at a threshold of top-layer ψ_s approx. −0.1 MPa. Numerical analyses regarding $g_m/V_{cmax}/J_{max}$ effects on photosynthetic performance in rice and between rice and winter wheat documented that in context of climate change, consider growth environment-induced differences in temperature responses of photosynthetic parameters among cereal crops is indispensable to better predict interactions among soil-plant-atmosphere consortium.