In rice, a small increase in nighttime temperatures results in reduced grain yield and quality. In contrast to increased daytime temperatures, a 1°C increase in temperature at night results in up to 10% yield loss in rice. How day and night temperature increases produce opposite effects on yield is not well understood. The molecular effects of warmer nighttime temperatures (**WNT**) have not been evaluated in field conditions where the normal daily fluctuation between day and night temperatures exceeds the increase in nighttime temperature (2-3°C) that produces detrimental effects. Here we describe the transcriptional effects of warmer nights during the reproductive phase in field-grown rice panicles acclimated to a 2-3°C increase in night temperatures. As previously reported, WNT have a significant negative impact on yield. We observe that this mild increase in nighttime temperature results in genome-wide disruption of the timing of gene expression in panicle tissue. Transcripts with a rhythmic pattern of expression in control conditions are more sensitive to WNT than non-rhythmic transcripts. We identified transcriptional regulators whose predicted targets are enriched for sensitivity to WNT. The global effects on transcription we observe suggest that WNT disrupt the tight coordination between internal molecular events and the environment in the flowering panicle. These system-wide perturbations of timing in responses to WNT may disrupt the temporal coordination of molecular activities resulting in reduced productivity. The identification of affected transcripts and candidate regulators indicate potential molecular mechanisms driving sensitivity to nighttime temperatures and suggests candidates that can be targeted to improve tolerance.