Far-field Wireless Power Transfer (WPT) has attracted significant attention in recent years. Despite the rapid progress, the emphasis of the research community in the last decade has remained largely concentrated on improving the design of energy harvester (so-called rectenna) and has left aside the effect of transmitter design. In this paper, we study the design of transmit waveform so as to enhance the dc power at the output of the rectenna. We derive a tractable model of the nonlinearity of the rectenna and compare with a linear model conventionally used in the literature. We then use those models to design novel multisine waveforms that are adaptive to the channel state information (CSI). Interestingly, while the linear model favours narrowband transmission with all the power allocated to a single frequency, the nonlinear model favours a power allocation over multiple frequencies. Through realistic simulations, waveforms designed based on the nonlinear model are shown to provide significant gains (in terms of harvested dc power) over those designed based on the linear model and over nonadaptive waveforms. We also compute analytically the theoretical scaling laws of the harvested energy for various waveforms as a function of the number of sinewaves and transmit antennas. Those scaling laws highlight the benefits of CSI knowledge at the transmitter in WPT and of a WPT design based on a nonlinear rectenna model over a linear model. Results also motivate the study of a promising architecture relying on large-scale multisine multiantenna waveforms for WPT. As a final note, results stress the importance of modeling and accounting for the nonlinearity of the rectenna in any system design involving wireless power.