‘Functional foods’ promote human health beyond the provision of essential nutrition, and are a major growth area for the agrifood industry and related research activity. It would be advantageous to incorporate functional food traits into the national peanut breeding program as criteria of kernel quality, with the ultimate goal of developing new cultivars that would boost health-focused product development, differentiation, and marketing. Peanut kernels contain a range of antioxidant phytochemicals including several phenolic acids, flavonoids and stilbenes (e.g. resveratrol), which benefit consumer health through apparent anti-inflammatory, antimicrobial and anticancer activities. We screened 58 genetically diverse peanut lines from the Australian breeding program for their antioxidant activity using four popular in vitro assays, i.e. the ORAC, ABTS, DPPH and Folin-Ciocalteu Total Phenols assays. This paper discusses the extent of genotypic variation in antioxidant activity, role of in vitro assays, their methodology and potential for their incorporation as future selection criteria in the breeding program.