The aim of the present research was to study changes in the major anti-oxidative enzyme activities known to be associated with the apoplast, during the induction of blossom-end rot (BER) in bell pepper (Capsicum annuum L.) fruits grown under saline conditions. Pepper plants of the BER-sensitive cv. ‘Mazurka’ and less-sensitive cv. ‘Selica’ were grown under control, low- and high-salinity irrigation regimes. Fruits were harvested continuously and, after approx. 7 months under these conditions, BER symptoms started to appear (in the Spring season) and fruits were sampled for biochemical measurements. The intercellular washing fluid (IWF; apoplast fraction) of the fruit pericarp was prepared and enzyme activities in that fraction were determined. The results showed that production of reactive oxygen species (ROS) in the fruit apoplast was higher in ‘Mazurka’ than in ‘Selica’. Apoplastic peroxidase and superoxide dismutase (SOD) activities, and the concentration of ascorbic acid, increased during ‘Selica’ fruit development, whereas the concentration of H2O2 decreased. During the stage of rapid growth, when fruits are most susceptible to BER, apoplastic peroxidase activity was greatly enhanced in the healthy pericarp of BER-affected fruits compared to healthy fruits. Under saline conditions, apoplastic peroxidase and SOD activities, as well as ascorbic acid and H2O2 levels, increased in healthy fruits of the resistant cultivar ‘Selica’; whereas, in healthy fruit of the BERSensitive cultivar ‘Mazurka’, apoplastic peroxidase activity decreased while the level of ascorbic acid increased, but to a much lesser extent than in ‘Selica’. SOD activity and H2O2 levels increased similarly in both cultivars with increasing levels of salinity. It is proposed that apoplast-associated peroxidase activity and ascorbic acid concentration are increased coordinately in response to salt stress and may be part of a protective anti-oxidation mechanism that determines cultivar sensitivity to BER.