Lincomycin-treated pumpkin leaves were illuminated with either continuous light or saturating single-turnover xenon flashes to study the dependence of photoinactivation of photosystem II (PSII) on the mode of delivery of light. The flash energy and the time interval between the flashes were varied between the experiments, and photoinactivation was measured with oxygen evolution and the ratio of variable to maximum fluorescence (Fv/Fm). The photoinhibitory efficiency of saturating xenon flashes was found to be directly proportional to flash energy and independent of the time interval between the flashes. These findings indicate that a low-light-specific mechanism, based on charge recombination between PSII electron acceptors and the oxygen-evolving complex, is not the main cause of photoinactivation caused by short flashes in vivo. Furthermore, the relationship between the rate constant of photoinactivation and photon flux density was similar for flashes and continuous light when Fv/Fm was used to quantify photoinactivation, suggesting that continuous-light photoinactivation has a mechanism in which the quantum yield does not depend on the mode of delivery of light. A similar quantum yield of photoinhibition for flashes and continuous light is compatible with the manganese-based photoinhibition mechanism and with mechanisms in which singlet oxygen, produced via a direct photosensitization reaction, is the agent of damage. However, the classical acceptor-side and donor-side mechanisms do not predict a similar quantum yield for flashes and continuous light.

Key words: Cucurbita maxima, light response curve, photoinhibition, photosystem II, single-turnover flashes, xenon flashes.