

# Drought Tolerance Mechanisms in Plants: Physiological Responses Associated with Water Deficit Stress in *Solanum lycopersicum*

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## Abstract

## Physiological Traits Associated with Water Stress Tolerance in Plants

### Chlorophyll parameters

Chlorophyll fluorescence (CF) has been widely used in water stress studies in various plants including tomatoes [22], maize [23], potato [24], cotton and peanut [25]. It is as light that chlorophyll molecules re-emit upon return from excited to non-excited states [26].



stress caused an oxidative stress induced membrane damage. In a heat stress study, it was demonstrated that ROS were the prime cause of

(PBZ), a clear indication of its critical role in protecting membranes from damage in drought stress [78]. While electrolyte leakage has been widely used in many crop species and tree seedlings to assess salt, heat, water and biotic stress tolerance, research must be scaled up to authenticate its



sensing applications: mechanisms and challenges. *Journal of Experimental Botany* 65: 4065-4095

31. Maxwell K, Johnson GN (2000) Chlorophyll fluorescence: a practical guide. *Journal of Experimental Botany* 51: 659-668
32. Lichtenthaler HK, Miehe JA (1997) Fluorescence imaging as a diagnostic tool for plant stress. *Trends in Plant Science* 2: 316-320
33. Zhu XG, Baker NR, Ort DR, Long SP (2005) Chlorophyll a fluorescence induction kinetics in leaves predicted from a model describing each discrete step of excitation energy and electron transfer associated with photosystem II. *Planta* 223: 114-133
34. Fracheboud Y, Haldimann P, Leipner J, Stamp P (1999) Chlorophyll fluorescence as a selection tool for cold tolerance of photosynthesis in maize (*Zea mays* L.). *Journal of Experimental Botany* 50: 1533-1540
35. Zlatev Z (2009) Drought-induced changes in chlorophyll fluorescence of young wheat plants. *Biotechnology & Biotechnological Equipment* 23: 438-441.
36. Baquedano FJ, Castillo FJ (2006) Comparative ecophysiological responses of drought on seedlings of the Mediterranean water-saver *Pinus halepensis* and water-spenders *Quercus coccifera* and *Quercus ilex*. *Trees* 20: 689
37. Boundless (2017) Movement of Water and Minerals in the Xylem. *Boundless Biology*. Boundless
38. Diez R (2015) How plants absorb water.
39. Pietragalla

75. Benlloch-González M, Arquero O, Fournier JM, Barranco D, Benlloch M (2008) K<sup>+</sup> starvation inhibits water-stress-induced stomatal closure. *Journal of Plant Physiology* 165: 623-630
76. Ritchie GA, Landis TD (2006) Seedling quality tests: Root electrolyte leakage. *Forest Nursery Notes USDA For Serv PNW Region Winter*.
77. Bolat I, Dikilitas M, Ercisi S, İkinci A, Tonkaz T (2014) Effect of water stress on some morphological, physiological, and biochemical characteristics and bud success on apple and quince rootstocks.