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Effects of high EC, planting location inside the greenhouse, and cultivar on leaf gas exchange and fruit quality of hyroponic tomato (*Lycopersicon esculentum*)

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Manipulation of the EC of hydroponic solution during fruit development has been known to improve fruit quality of tomato. However, optimum EC level for maximizing fruit quality while minimizing potential yield reduction will be dependent on other environmental conditions (such as air temperature and light intensity) and cultivar. Five cultivars (Blitz, Mariachi, Quest, Rapsodie, and Trust) of tomato were grown hydroponically on rockwool (seeded July 26, 2001; transplanted August 23, 2001, and final harvest June 11, 2002) in a University of Arizona CEAC greenhouse (465 m², north-south orientation). Thirty seven weeks after transplanting, EC level of the nutrient solution was increased gradually from 2.6 dS m⁻¹ (conventional level) to approximately 5 dS m⁻¹ by increasing the entire nutrient concentration in order to examine plant responses to high EC. Total soluble solid concentration (TSS, %Brix at 20°C) of fruits gradually increased with time from 2 to 6 weeks after increasing EC. The highest TSS was 7%, observed for Mariachi planted on the south side of the greenhouse. Fruits harvested from the south side of the greenhouse had greater TSS than those from the north side. This was due to higher air temperature and greater daily PPF (photosynthetic photon flux) received on the south side than on the north side of the greenhouse. Cultivar showed a relatively weak effect on TSS due to the large variation of TSS within the same cultivar. Single leaf gas exchange rates measured at a constant PPF (1000 μmol m⁻² s⁻¹) indicated that both planting location and cultivar affected leaf transpiration rate but not net photosynthetic rate. TSS increased with increasing mole ratio of net photosynthetic rate and transpiration rate (P/T ratio), but neither photosynthetic rate nor transpiration rate had significant effects on TSS, regardless of planting location or cultivar. This indicated that greenhouse environment, cultivar, and cultivation techniques reducing transpiration rate while maintaining net photosynthetic rate would potentially increase the TSS and improve the fruit quality. It also suggests that quantitative understanding of in situ plant gas exchange rate will be helpful in selecting environmental conditions, cultivation practices, and cultivars for high quality hyroponic tomato production.