Evaluation of an in-vitro Salt Tolerance Screening Method for Colocasia esculenta (Taro) Cultivars in Terms of Reliability and Efficiency Through Comparison With ex-vitro Methodology

Garcia , Kim Gerald (School: Fa'asao Marist High School)

Assessing the salt tolerance of different Colocasia esculenta (taro) varieties and cultivars is crucial due to increasing saltwater intrusion in low-lying plantations in American Samoa, where sea level rise is four times faster than the global average. Traditional ex-vitro salt tolerance screenings for taro are often resource and time-intensive. An in-vitro screening method was further developed and evaluated for reliability and efficiency to address this issue. Taro cultivars 'D' and '3B' were subcultured in Murashige and Skoog growth medium supplemented with Sodium chloride concentrations (NaCl) of 20mM, 40mM, 80mM, 120mM, and control with two, four, and eight-week screening durations. An ex-vitro screening was also conducted with the same cultivars and NaCl concentrations. Results show that cultivars D and 3B had the same level of salt tolerance among all concentrations (all p-values> 0.13), with a four-week screening duration being the most efficient (all p-values> 0.058) with a strong linear relationship between increasing NaCl concentrations and % biomass reduction (r^2= 0.963 for D and r^2= 0.999 for 3B), and a high positive correlation coefficient with ex-vitro results (R= 0.884), proving its reliability. An overall efficiency analysis also shows that in-vitro methodology requires 50% less time, 96.13% less general cost, and 98.2% less space. The results of this study suggest in-vitro screenings as a reliable, likely more accurate, and significantly more efficient alternative to expedite efforts to maintain sustainability for coastline environments in American Samoa and other salt-affected regions worldwide that rely on taro as a staple crop, as areas commonly used for taro production are also areas prone to saltwater intrusion.

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