

## **GENOMICS-DRIVEN GENETICS TO SUPPORT DEVELOPMENT OF SALTWATER AGRICULTURAL SYSTEMS**

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*salinity tolerance, quinoa, tomatoes, Red Sea Farms*

One-third of the world's food is produced under irrigation. This is challenged by over-exploitation of water resources and global environmental change. This talk will focus on the use of forward genetics to discover genes affecting salinity tolerance in barley, rice, and tomatoes, along with some recent genomics in quinoa, a partially domesticated crop with high salinity tolerance. Rather than studying salinity tolerance as a trait in itself, we dissect salinity tolerance into a series of components that are hypothesised to contribute to overall salinity tolerance.

For tomatoes, the focus is on association genetics of tolerance in wild tomatoes. Tomatoes have been phenotyped in The Plant Accelerator® and in the field for three years, and analyses are currently in progress.

For quinoa, the genome has been sequenced to high quality, and now about 1,000 lines have been re-sequenced. Up to 1,300 lines are being phenotyped in The Plant Accelerator and over a dozen field trial sites globally to identify natural variation in a range of domestication and tolerance traits.

The application of this approach provides opportunities to significantly increase abiotic stress tolerance in crops and thus contribute to increasing agricultural production in many regions.

To deliver our research, we have now established a company, Red Sea Farms LLC, where we combine engineering and plant science to develop and use saltwater-based agricultural systems, to reduce the water and carbon footprint of modern agriculture, and to do this environmentally sustainably and economically viably.

I have also recently taken on a new task, to develop a \$3bn strategic plan for the food sector of NEOM, a new “sustainable hi-tech city of the future” being established on 25,000 km<sup>2</sup> of land in north-western Saudi Arabia. This provides a further opportunity for delivering sustainable food solutions in an environment with a challenging set of abiotic stresses. Plans for this new city will also be introduced.