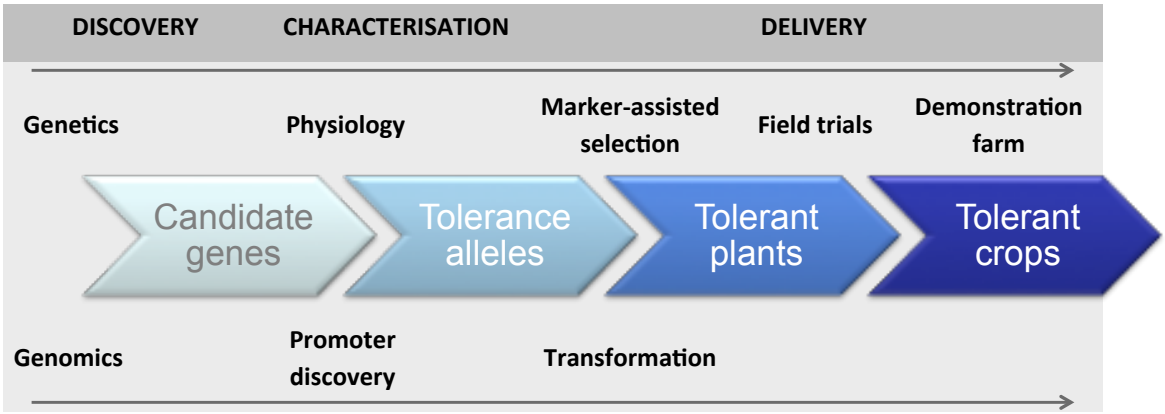
Center for Desert Agriculture

The Salt Lab

Mark Tester

One approach to improving desert agriculture is to increase the tolerance to salinity of existing crops, such as wheat, barley and tomatoes. The aim of research in The Salt Lab is to make fundamental discoveries into the molecular genetic basis for increased salinity tolerance in some plants, and apply these discoveries to increase the salinity tolerance of crops such as wheat, barley and tomatoes. This builds directly on work over the past decade where mechanisms of tolerance have been discovered and characterised, then delivered to commercial crops using both GM and marker-assisted selection.

The Projects are organised as part of a "discovery and delivery pipeline":



In the Discovery project, a range of forward genetic and genomic approaches are being used to discover genes that affect traits that are likely to contribute to salinity tolerance. These genes, and others discovered previously by members of the CDA and other researchers, are being characterised to elucidate in detail mechanisms of action and natural variation within the target crops. The Delivery project focuses on the alteration of genes likely to alter salinity tolerance in crop plants, and the testing of the effects of these alterations on yield in the field. Work in all Projects is occurring in parallel, as knowledge of some genes has advanced to the stage of field trials, whereas discovery of fundamental processes is still required for other genes and traits.

Salinity tolerance is complex and involves many genes. It is therefore necessary to study not the molecular genetic basis of salinity tolerance as a trait in itself, but to study the mechanisms of traits that are hypothesized to contribute to salinity tolerance. The most intensively studied of these traits is exclusion of Na^+ from leaf blades, mainly because it is relatively straightforward to phenotype. Focusing on this has led to significant increases in salinity tolerance in both controlled conditions and even as measured by yield in the field. The other main traits which have also been hypothesized to contribute to salinity tolerance are:

- Osmotic tolerance, which is related to minimization of reductions in shoot growth upon addition of salt, independent of the accumulation of salt in the shoot; and
- Tissue tolerance, where high salt concentrations are found in leaves but are compartmentalized at the cellular and intracellular level (especially in the vacuole).

Activity in each of the Projects are being directed to all three major traits: Na^+ exclusion, osmotic tolerance, tissue tolerance.