Climate smart and sustainable agricultural solutions - Case Study

According to the 2015 Food and Agriculture Organization report around 20% irrigated land is salinity affected. Soon these large proportion of land will be useless if we will not be able to produce abiotic stress tolerant crops. The gradually changing environment has altered the global patterns of abiotic stresses such as salinity, drought, high and low temperature, and increase the incidence of severe weather events. This has also impacted the crop productivity significantly. Creating an urgent need for crop improvement or development of climate resiliance crops.

Jaykumar Patel, as a part of the Newton Bhabha Fund PhD Placement Programme funded by the Department for Business Energy and Industrial Strategy(BEIS), UK and Department of Biotechnology, India delivered by the British Council attempted to provide simple sustainable solutions to this problem. He studied the Salicornia *brachiata*, an extreme halophyte, that can tolerate severe abiotic stresses. As a part of the study, they isolated several abiotic stress responsive genes and promoters for functional validation and in order to understand the abiotic stress tolerance molecular mechanism. A selection of homologue of Aquaporin gene which plays important role in water homeostasis in plants was also made.

The study has been able to develop transgenic model plant tobacco showing significant improvement in growth and morphology under abiotic stress condition. Under Salinity treatment (100mM NaCl and 200mM NaCl) seedlings of transgenic tobacco shows 40-70% higher root length whereas 31-46% higher shoot length compared to wildtype and vector control plants. Similarly, in drought stress (150mM Mannitol and 300mM Mannitol) transgenic seedling shows 40-70% higher root length whereas 31-46% higher shoot length compared to wildtype and vector control plants. Freshweight of transgenic seedlings were also increased as compared to control plants by 2.5 to 2.9 time under abiotic streses.

Newton-Bhabha programme has seeded a long term international collaborative work between CSIR-Central Salt and Marine Chemicals Research Institute and Aberystwyth University. Promising results in model plants tobacco motivated him to develop transgenic crop using same aquaporin gene for functional validation. Transgeenic wheat will be produced under Community Resource for Wheat and Rice Transformation project at NIAB, UK funded by BBSRC BBR and transferred to Aberystwyth University for analysis.

Comparative study of effect of abiotic stresses on transgenic and control tobacco plants

Project title: Cloning and Characterization of Aquaporin-like gene from Salicornia brachiata for abioatic stress tolerance
Delivery Partner: British Council
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Project lead(s): Dr. Dylan Phillips & Prof. Huw Jones, Dr. Avinash Mishra
SDG(s): SDG 1,2 – No poverty, Zero Hunger