











COLLEGE OF AGRICULTURE



CLIMATE RESILIENCE AGRICULTURE

Climate Resilience Agriculture

KLEF

KLEF Deemed to be University (KLU) is recognized as one of the premier institutes in India, holding an impressive NIRF rank of 22 (University Ranking, 2024). The university leadership is deeply committed to advancing research initiatives and enhancing teaching methodologies across all departments to establish KLU and KLCP as benchmarks of excellence in pharmaceutical education and research. To achieve this vision, the faculty at KLCP includes distinguished professionals from leading institutions across the country, bringing top-tier expertise in research and teaching.

KLCOA

KL College of Agriculture is a significantly emerging college in KLEF and has successfully produced one batch of undergraduate students who have secured good position in agriculture and allied industries. As a new research direction of KLEF, we are establishing individual laboratories dealing with key subjects in agriculture such as biotechnology, plant physiology, plant breeding, agronomy and soil science. This department holds ample opportunities to flourish in great manner by the implementation of postgraduates and research curriculum sooner.



• To ensure the food security in the face of climate change through sustainable agriculture.



MISSION

- To generate the resilient crops that meet out calorie demand of ever-increasing population through transgenesis and genome editing (CRISPR/Cas9) approaches.
- To establish cutting edge laboratory in the KL University that encompasses the advances in plant stress biology and biotechnology.



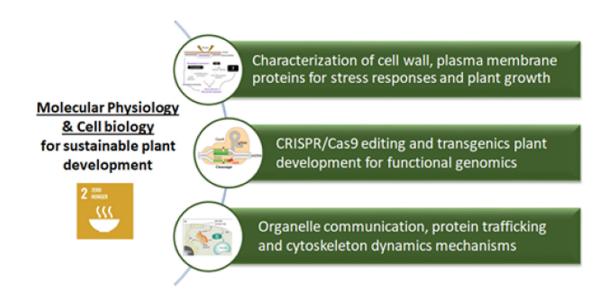
OBJECTIVES

The ultimate aim of agriculture has been on the undiminishing productivity because of culmination of key factors such as ever-increasing population, decreasing arable land and drastic climate change. Among which, climate change is of serious concern since it significantly affects crop yield that raises concern on the food security of meeting the demands of unprecedented population. To cope up with the issues affecting Agriculture, the research should be addressed betimes at multiple layers of plant biological research. Drought stress is one of the intensive elements affecting the crop yield. Investigations on the drought administered plant physiology specifically at cellular and developmental context is the key domain to be further inscribed for rectifying the productivity issues. Our ultimate research goal is towards the contribution to the global agriculture by means of sagacious investigation on the early signaling elements involved in the abiotic and biotic stress mechanisms. The following are my broad objectives in the investigation on stress signaling of plants.

- Mechanisms of drought and salt stress perception in plants through genetics, plant physiology and cell biological approaches.
- Cell biology of organelle communication and protein trafficking involved during stress sensing or signaling such as the role of ER-PM connection in plants.
- Translational biology of basic research findings into the crop plants and its implications for sustainable agriculture.



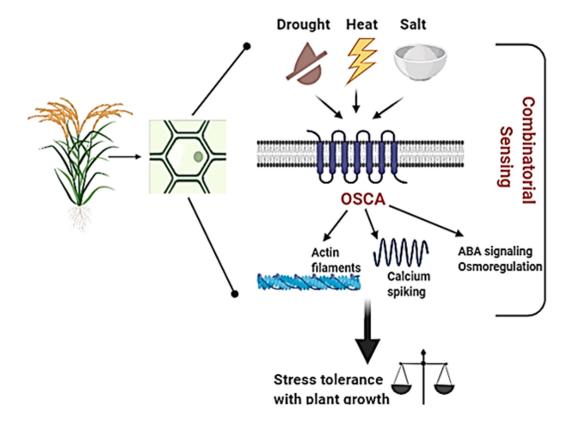
Research foci of climate resilience group that align with the goals of SDG



Research group - Approaches

- Gene identification through discovering the potential resilience genes.
- Generation of gene edited and genetic engineered plants through CRISPR/Cas9 and transgenic technologies.
- Characterization of gene edited and genetic engineered plants for tolerance to biotic and abiotic stressors.
- Unveiling molecular mechanism through RNA-Seq, gene expression, protein interaction studies and linking signaling modules.

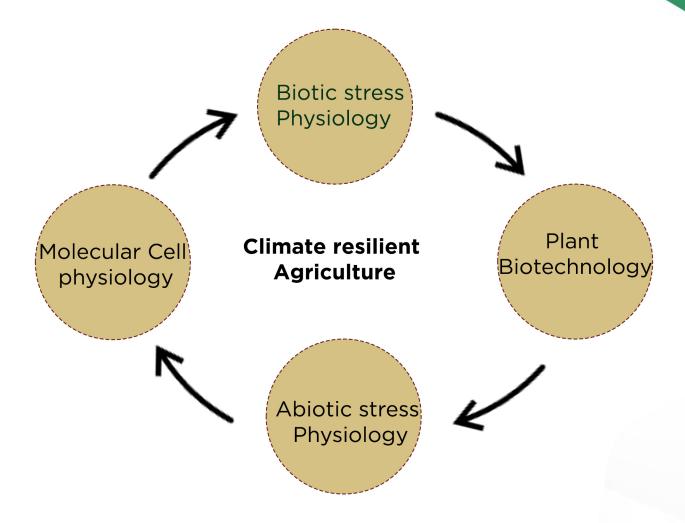
Hypothetical model illustrating one of the hypothetical resilient genes and its proposed mechanism of stress resilience



Research group - Significance

- The research objectives of climate resilience group could likely shed lights on under-explored areas in stress physiology with perspective to the sensing and early signaling.
- We are now witnessing the evidence of erratic changes on rain fall, temperature, plant productivity under climate change. So, our basic results on upstream components in stress field might be serving as promising clues for the future explorations on stress biology and climate science for the sustainable agriculture.

Research areas to be investigated in Climate Resilience group



- Abiotic stress physiology: Drought, Salt, heat, flooding and cold stresses.
- Biotic stress physiology: Pathogens (Fungi, Bacteria, Viruses) and Pests.
- Plant Biotechnology: Generation and characterization of transgenic and gene edited plants through CRISPR/Cas9.
- Molecular Cell physiology: Dissecting molecular mechanisms for stress resilience at the whole plant and cellular level.

Current Projects of Research Center Head : **Dr. M. Nagaraj Kumar**

Completed: Principal Investigator in 'Drought stress sensing and signaling mechanisms of histidine kinases in rice'- Ramalingaswami Re-entry fellowship - DBT, Gol.

Ongoing: Co-Principal Investigator in 'Site-directed mutagenesis of low affinity nitrate transporter gene for improving nitrogen uptake efficiency in aerobic rice'- DBT, Gol.

Ongoing: Cooperating Investigator in 'CRISPR Crop Network' Targeted improvement of stress tolerance, nutritional quality and yield of crops by using genome editing' from NASF.

Submitted: Unravelling the mechanism of stress mitigation by Melatonin under drought+salt incidence in rice. Seed Grant submitted to KLEF on October, 2024.

Key publications of group leader

Kumar, M.N., Bau, Y.C., Longkumer, T. and Verslues, P.E. (2019) Low water potential and At14a-Like1(AFL1) effects on endocytosis and actin filament organization. Plant Physiology. 179: 1594-1607.

Rajesh Kalladan, Jesse R Lasky, Sandeep Sharma, M. Nagaraj Kumar, Thomas Juenger, David L Des Marais, Paul E Verslues. (2019) Natural variation in 9-cis epoxycarotenoid dioxygenase 3 and ABA accumulation. Plant Physiology 179:1620-1631.

Kumar, M.N., Hsieh, Y.-F., Verslues, P.E. (2015) At-14a Likel participates in membrane-associated mechanisms for promoting growth during drought in Arabidopsis thaliana. PNAS: Proceedings of National Academy of Sciences of the USA. 112(33): 10545-10550.

Kumar, M.N., and Verslues, P.E. (2015) Stress physiology functions of the Arabidopsis histidine kinase cytokinin receptors. Physiologia Plantarum 154: 369-380.

Verslues, P.E., Lasky, J.R., Juenger, T.E., Liu, T.-W., Kumar, M.N., (2014) Genome wide association mapping combined with reverse genetics identifies new effectors of low water potential-induced proline accumulation in Arabidopsis thaliana. Plant Physiology164:144-159

Kumar, M.N., Jane, W.-N., Verslues, P.E. (2013) Role of the putative osmosensor Arabidopsis Histidine Kinase 1 (AHK1) in dehydration avoidance and low water potential response. Plant Physiology 161: 942-953

Climate Resilience Team

Research Group Head

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Dr. Shivananda.

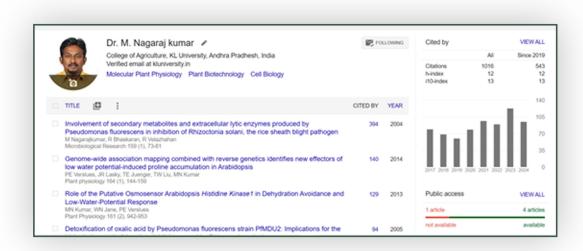
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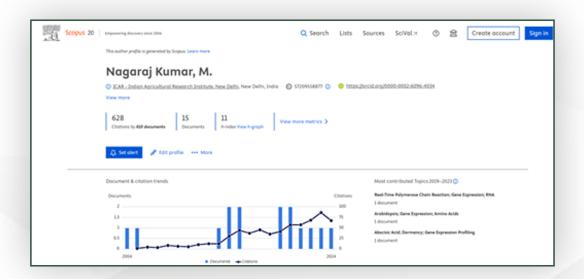
Dr. Priyanka.

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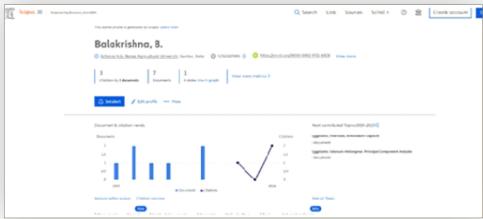
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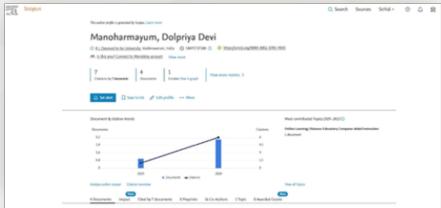


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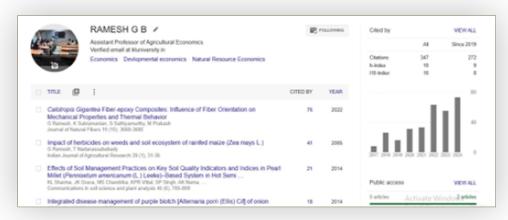


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