

Hon'ble Prime Minister Shri. Narendra Modi dedicated the "Nanaji Deshmukh Plant Phenomics Centre" at ICAR-IARI, New Delhi to the Nation on 11th October 2017

Development of climate resilient crop varieties and precision agriculture management techniques are necessary for sustaining the food security in the climate change scenario. One of the fundamentals requirements to achieve this goal is precise quantification of response of plants to different stresses for identification of superior genotypes and genes. Conventional phenotyping is time and labour intensive, and often destructive and hence is a bottleneck in breeding crop varieties with climate resilience. Since genotype x environment interaction is dynamic, spatial and temporal phenotyping is necessary to understand the plant phenome. To bridge the phenotype-genotype gap, the multi-disciplinary science of “*Phenomics*” has emerged recently. Similar to MRI or CT-Scan used diagnosis of health status and diseases in humans, Phenomics also uses non-invasive sensors and advanced image processing computational programmes to non-destructively characterize plants in near real-time.

The Indian Council of Agricultural Research (ICAR) through National Agricultural Science Fund (NASF) established a state-of-the art plant phenomics facility at the Indian Agricultural Research Institute, New Delhi. This facility is the largest in India and one of best facility in terms of analytical capabilities among the public funded Institutions in the world. The centre also comprises of “*Climate Controlled Facility*” with 8 different greenhouse chambers developed by the Institute through the funding support from National Initiative on Climate Resilient Agriculture (NICRA), ICAR.



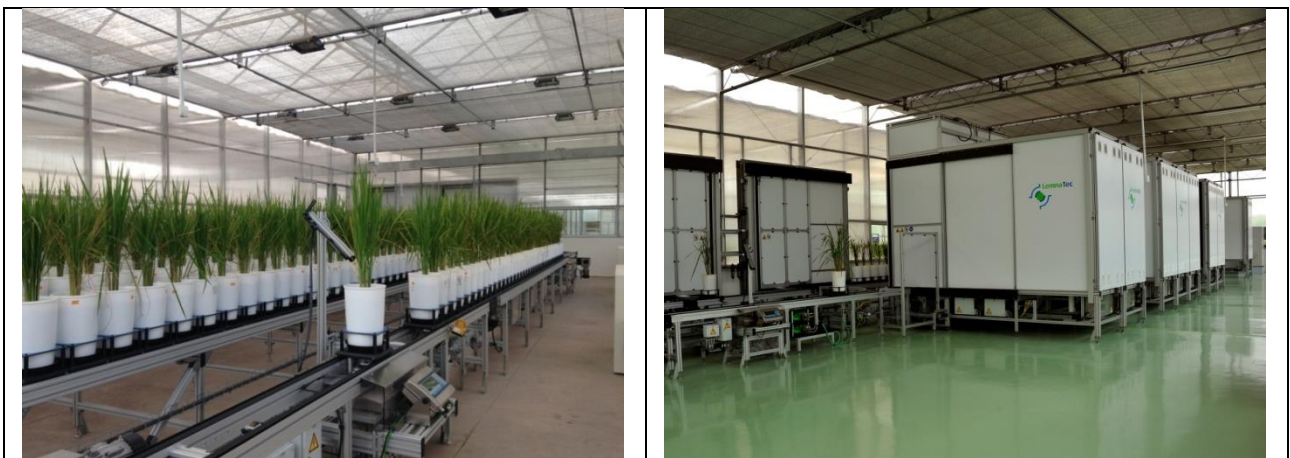
A birds-eye view of Nanaji Deshmukh Plant Phenomics Centre at ICAR-IARI, New Delhi

The facility has four hi-tech climate controlled greenhouses for cultivation of plants in defined environmental conditions. For plant cultivation, the facility is equipped with 1200 plant carriers with RFID chip tag. The plant carrier on moving field conveyer system randomizes plants within the greenhouse and carries plants for automated weighing and watering, and imaging at various imaging platforms. The facility has 5 automated weighing and watering stations for precise imposition of drought stress to plants and to measure transpirational water loss and water use efficiency of plants. “*Climate Controlled Facility*” has eight different greenhouse chambers with precision control of temperature and CO₂. This will be highly useful to study the interactive effects of elevated CO₂ with heat and other climatic stress factors.



“Climate Controlled Facility” at Nanaji Deshmukh Plant Phenomics Centre, ICAR-IARI, New Delhi

For non-destructive phenotyping, eight different imaging platforms viz. 1) Thermal Infra-red (8000-14000 nm) imaging, 2) Chlorophyll fluorescence imaging, 3) Unit with calibrated light source (for optional sensors – Spectroradiometer/FTIR), 4) Root imaging - Near Infra-Red (900 to 1700nm) & Visible color imaging, 4) Visual color imaging, 5) Near Infra-Red shoot imaging (900 to 1700nm), 7) Visible-Near Infra-Red Hyperspectral imaging (400-1000nm), and Short-Wave Infra-Red Hyperspectral imaging (1000-2500nm). Plants can be lifted and turned in desired angles to record side images and top images inside the imaging units. These sensors are useful to measure early vigor, growth rate, biomass, senescence, photosynthetic pigments, photosynthesis efficiency, plant water content, chemical composition such as sugars synthesized by the plants, nitrogen status, etc. in response to different stresses and climate conditions. The images captured by the sensors are analyzed with advanced image processing software – Scanalyzer 3D with LemnaControl, LemnaLauncher, LemnaGrid, LemnaMiner & LemnaBase tools to obtain pixel-wise phenotype data at various phenotypic traits of plants.



Plant cultivation on moving field conveyer system and various imaging platforms in Nanaji Deshmukh Plant Phenomics Centre at ICAR-IARI, New Delhi

Phenomics will be useful for accurate phenotyping of the germplasm throughout the life cycle in controlled stress conditions to identify superior genes and genotypes for development climate resilient crop varieties. The image features identified in phenomics will be useful for UAV- and/or remote sensing-aided applications for resource and crop management such as fertilizer and water management, crop health and disease diagnosis for precision agriculture. The phenomics centre will enable development globally competent scientific human resources in cutting edge research area of digital phenotyping and big data science for sustaining crop productivity under future climate change scenario.

This centre was dedicated to the Nation by Shri Narendra Modi, Hon'ble Prime Minister of India in the name of "Nanaji Deshmukh Plant Phenomics Centre" on 11th October 2017, on the event of the birth centenary celebration of Nanaji Deshmukh at IARI, Pusa, New Delhi.



Shri. Radha Mohan Singh, Hon'ble Minister for Agriculture and Farmers Welfare Government of India welcomed Shri Narendra Modi, Hon'ble Prime Minister of India at Nanaji Deshmukh Plant Phenomics Centre. Shri. Parshottam Rupala, Hon'ble Minister of the state Government of India - Agriculture, Farmers welfare & Panchayati Raj, Dr. Trilochan Mohapatra , Secretary (DARE) & Director General (ICAR), Shri. S.N. Tripathi, Additional Secretary & Financial Advisor (DARE/ICAR), Dr. A.K.Singh, Deputy Director General (Agricultural Extension) & Director IARI (Additional Charge), Dr Anand K. Singh, Deputy Director General (Horticultural Science), Dr. K.Vinod Prabhu, Joint Director (Research), IARI, Dr P. K. Agrawal, Assistant Director General, NASF, and Dr. Madan Pal, Principle Scientist were present in the reception.



Shri. Narendra Modi, Hon'ble Prime Minister of India, inaugurating the "Nanaji Deshmukh Plant Phenomics Centre" on 11th October 2017 at IARI, Pusa, New Delhi. The Union Minister for Agriculture and Farmers Welfare, Shri Radha Mohan Singh, the Minister of State for Agriculture & Farmers Welfare and Panchayati Raj, Shri. Parshottam Rupala are also seen and Dr. Trilochan Mohapatra, Secretary (DARE) & Director General (ICAR), Dr. A.K. Singh, Deputy Director General (Agricultural Extension) & Director IARI (Additional Charge) are also seen.



Inaugural plaque of inauguration of the "Nanaji Deshmukh Plant Phenomics Centre" on 11th October 2017 at IARI, Pusa, New Delhi by the Hon'ble Prime Minister of India, Shri Narendra Modi.



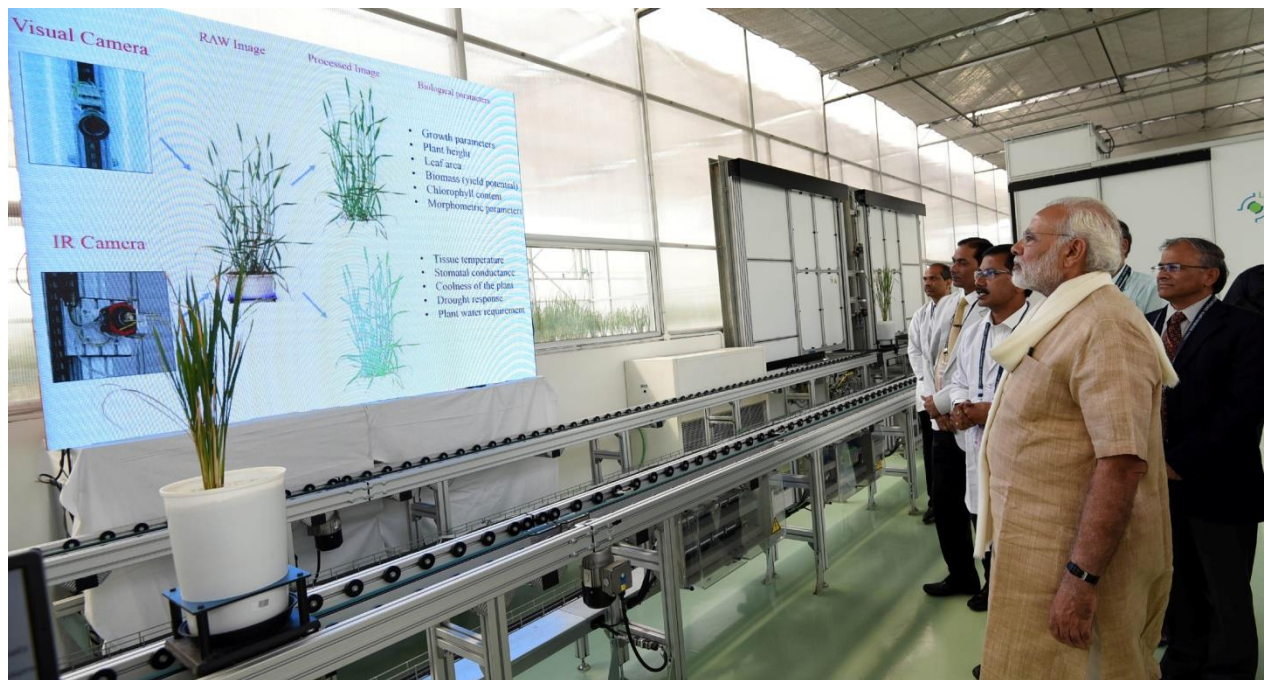
Reception of Shri Narendra Modi, Hon'ble Prime Minister of India at the "Nanaji Deshmukh Plant Phenomics Centre" on 11th October 2017 at IARI, Pusa, New Delhi by the Minister of State for Agriculture & Farmers Welfare and Panchayati Raj, Shri Parshottam Rupala, Dr. Trilochan Mohapatra, Secretary (DARE) & Director General (ICAR), Dr. A.K. Singh, Deputy Director General (Agricultural Extension) & Director IARI (Additional Charge), and Dr. K.Vinod Prabhu, Joint Director (Research), IARI (Clock-wise from the top).



The Prime Minister, Shri Narendra Modi on the inaugural visit of the Nanaji Deshmukh Plant Phenomics Centre, IARI, on October 11, 2017. The Union Minister for Agriculture and Farmers Welfare, Shri Radha Mohan Singh, the Minister of State for Agriculture & Farmers Welfare and Panchayati Raj, Shri Parshottam Rupala and Dr. Trilochan Mohapatra, Secretary (DARE) & Director General (ICAR), Shri. S.N. Tripathi, Additional Secretary & Financial Advisor (DARE/ICAR) and Dr. Viswanathan C, In-charge, Nanaji Deshmukh Plant Phenomics Centre, IARI are also seen.



The Prime Minister, Shri Narendra Modi on the inaugural visit of the Nanaji Deshmukh Plant Phenomics Centre, IARI, on October 11, 2017. Automated weighing and watering of rice plant is being demonstrated.



The Prime Minister, Shri Narendra Modi on the inaugural visit of the Nanaji Deshmukh Plant Phenomics Centre, IARI, on October 11, 2017. Image processing and digital data mining are demonstrated.