January
2021

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ICAR

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NIASM

Project Coordinator

.... a monthly update

ICAR-National Institute of Abiotic Stress Management
Baramati, Pune, Maharashtra 413115

Project Coordinator

.... a monthly update

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From Director's Desk .....

Greetings from ICAR-NIASM !!!

The current issue on project coordinator highlights the progress made under all the ICAR-NIASM projects during January, 2021 and targets for February, 2021. One of the major achievements of last month was successful organization of "Technology Week - KRUSHIK" jointly with Krishi Vigyan Kendra, Baramati from 18-24 January, 2021. More than 3000 farmers visited the institute to witness the live demonstrations and the experimental plots showcasing technology for establishing orchards of dragon fruit and other all fruit crops on shallow basaltic terrain, climate smart integrated farming system, conservation agriculture and SORF machine for sugarcane, alternative crops, livestock and fishery experimental ponds and fish museum, medicinal and herbal garden, genetic stock garden at NIASM. Besides, QR-NIASM, an app that provides a brief audio-visual information about the project, was installed at major experimental sites for easy and efficient dissemination of information to visitors. In addition, research and development efforts were made regarding selection and selfing of mutant plants of chia and quinoa, isolation of microbial strains from mangroves and sediments, development of ATIC & screening of genotypes.

I sincerely hope that this issue will help the scientists and the farm personnel of NIASM and other research Institutes for better coordination among project staff while implementing the planned activities. I thank Dr. Aliza Pradhan and her team for their dedication and sincerity in bringing out this publication and wish that the issue would be received well by readers across all domains.

(Himanshu Pathak)

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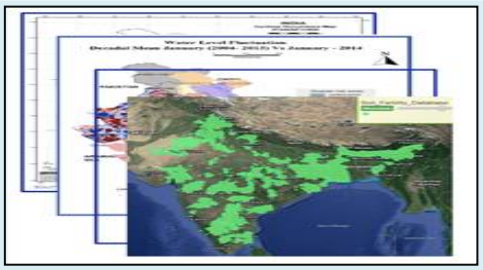
Glimpses of Inauguration of "KRUSHIK-2021" at ICAR-NIASM

UP 1. Abiotic Stress Information System (ASIS)

Geo-spatial digital maps of multiple abiotic stresses, management options and future scenarios

PI: Bhaskar B Gaikwad; **Co-PI(s):** Amresh Choudhary, Ram N Singh, Dhananjay D Nangare, Nitin P Kurade, Sachinkumar S Pawar, Mukeshkumar P Bhendarkar, Sunil V Potekar, Pravin H More



Concept of ASIS

Outputs

- Identification of indicators for vulnerability of livestock.
- Preparation of framework template for assessment of risk of thermal stress to poultry using excel worksheet.

Targets for next month

- Webapp for assessment of risk of thermal stress in poultry.
- Webapp of farm pond based aquaculture for abiotic stress conditions..
- Technical Draft on Methodology for Geospatial stress mapping.

UP 2. Germplasm Conservation and Management (GCM)

Genetic garden and gene bank for abiotic stress tolerant plants, animals and fisheries for food security and sustainability

PI: Boraiah K M; **Co-PI(s):** Ajay K Singh, Basavaraj, P S, Mahesh Kumar, Satish Kumar, Rajkumar, N Karthikeyan, Paritosh Kumar, Sanjeev K Kochewad, Mukesh kumar P Bhendarkar, Harisha C B, Pratapsingh Khapte, Jagadish Rane, Neeraj Kulakshetran, Pravin B Taware, Aniket More, Rushikesh Gophane, Lalitkumar Aher

Fish museum

Outputs

- Display of seeds of abiotic stress tolerant varieties/genotypes and diverse insect species in ATIC, ICAR-NIASM.
- Establishment of Fish museum in ATIC showing glimpses of the biodiversity of the abiotic stress tolerant freshwater fish specimens collected from farm & Bhima rivers stretch.
- Arrangement of collections of seeds/insects/fishes for visitors attraction as well as towards better understanding.

Targets for next month

- Collection of seed materials of abiotic stress tolerant crop varieties/genotypes/germplasm.
- Compilation of information on abiotic stress tolerant crop varieties/genotypes, animal & fish breeds.

UP 3. Model Green Farm (MGF)

Environment-friendly, economically viable, state-of-the-art model farm for abiotic stressed regions

PI: Dhananjay D Nangare; **Co-PI(s):** Himanshu Pathak , Goraksha C Wackchaure, Bhaskar B Gaikwad, Vanita Salunkhe, Rajkumar, Paritosh Kumar, Aliza Pradhan, Amresh Chaudhary, Mukesh kumar P Bhendarkar, Sangram B Chavan, Vijaysinha D Kakade, Pratapsingh S Khapte, Pravin B Taware, Rushikesh Gophane, Noshin Shaikh, Santosh Pawar, Avinash V Nirmale

Demonstration of dragon fruit orchard to farmers during Krushik 2021

Outputs

- Demonstration of dragon fruit and other fruit orchard establishment on shallow basaltic terrain to farmers during Krushik 2021.
- Survey of farmers growing dragon fruit in their fields.
- Establishment of dragon fruit seedlings for pathogenecity; multiplication of inoculum on Potato Dextrose Broth.
- Assessment of temperature requirement for optimum growth of dragon fruit pathogens.
- Completion of soil sampling in tamarind orchard.
- Installation and testing of pumping machinery in the farm.

Targets for next month

- Installation of drip system in sandalwood plants; analysis of soil samples collected from tamarind orchard.
- Molecular characterization of prominent fungal pathogens affecting dragon fruit cultivation.
- Evaluate effect of input type & stocking density on sediment & nutrient accumulation in water in farm pond.
- Monitoring the progress of work & testing of automation system in the field; dragon fruit farmers survey.

UP 4. Climate-smart IFS (CIFS)

Climate resilient integrated farming system in semi-arid region

PI: Sanjiv A Kochewad; **Co-PI(s):** Kamlesh K Meena, Goraksha C Wackchaure, Vanita Salunkhe, Rajkumar, Mukeshkumar P Bhendarkar, Aliza Pradhan, Amresh Chaudhary, N Subash, Laxman R Meena, Pravin B Taware, Patwaru Chahande

Jowar crop in CIFS

Outputs

- Completion of sowing of Lucerne fodder crop.
- Completion of planting of agroforestry plantations.
- Completion of laying of HDPE sheet in farm pond.
- Erection of trellis for growing cucurbits in multilayer farming.

Targets next month

- Installation of solar pump; laying of pipeline for micro-irrigation .
- Hoeing and weeding in rabi sown crops.
- Preparation a d submission of technical bulletin on CIFS.

FP 1. Atmospheric Stress Management

Adaptation and mitigation of atmospheric stress in crops, livestock, poultry and fishes for sustainable productivity and profitability

PI: Nitin P Kurade; **Co-PI(s):** Sachinkumar S Pawar, Sanjiv A Kochewad, Bhaskar B Gaikwad, Rajkumar, Mukeshkumar P Bhendarkar, Ram N Singh, Dhananjay D Nangre, Avinash V Nirmale, Sunil V Potekar

Collection of black soldier fly larvae

Outputs

- Recording of physiological responses body temperature, heart and respiratory rate; growth as well as status of external parasites in all the goat breeds.
- Collection of environmental parameters to access stress levels in goats and poultry birds and assessment of thermal stress risks for January.
- Recording of data on comparative infestation in different treatment groups in the experiment on IPM of fall armyworm in maize.
- Recording of growth parameters under the experiment of salinity tolerance of fish (GIFT tilapia), exposed to three different salinity levels of 5, 10 and 15ppt.
- Collection of black soldier fly larvae for its mass multiplication from Patas village.
- Collection and compilation of meteorological data.

Targets for next month

- Evaluation of stress parameters and parasitic prevalence in different breeds of goat.
- Amplification of Heat Shock Protein polymorphic region.
- Survey on fall armyworm in maize and collection of black soldier fly larvae in and around Baramati.
- Collection and analysis of Meteorological data of MH.
- Impact of salinity stress in GIFT Tilapia; development of Live fish feed culture unit.

FP 2. New Crops

Augmenting farm income in water scarce regions with alternative crops

PI: Jagadish Rane ;**Co-PI(s):** Ajay K Singh, Dhananjay D Nangre, Goraksha C Wackchaure, Mahesh Kumar, Satish Kumar, Karthikeyan N, Boraiah K M, Sanjiv A Kochewad, Aliza Pradhan, Amresh Chaudhary, Ram N Singh, Basavraj P S, Harisha C B

Selection and selfing in mutant plants of quinoa and chia

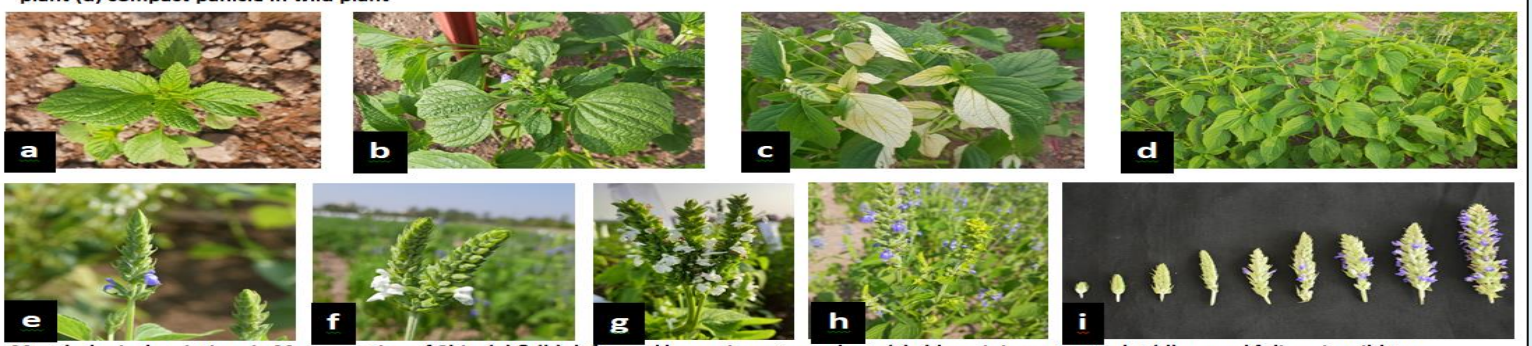
Outputs

- Recording of observations on morphological variations (foliage/flower/inflorescence) in mutants of chia and quinoa.
- Selection & selfing of mutant plants of chia (1500 no.) and quinoa (400 no.) by bagging.
- Tolerance of quinoa and chia genotypes to different salt concentrations during germination stage.

Targets for next month

- Hybridization (crossing) and floral biology study in chia.
- Initiation of pot experiment to study tolerance of quinoa varieties to salt stress.

Morphological variations in M_1 generation of Quinoa. (a) non serrated leaf in mutant plant (b) serrated leaf in wild/ normal plant (c) loose panicle in mutant plant (d) compact panicle in wild plant

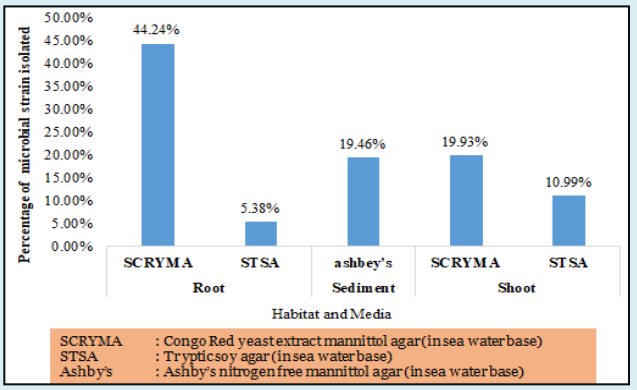


Morphological variations in M_1 generation of Chia. (a) & (b) deformed leaves in mutant plants (c) chlorosis in mutant palnt (d) normal foliage in wild type plants (e) single panicle in wild panicle (f), (g) branched panicle (h) deformed panicle (i) different stages of flowering in Chia.

FP 3. Bio-saline Agriculture

Exploitation of halophytic plant and associated microbiome for amelioration of saline agricultural land of arid & semiarid regions

PI: Satish Kumar; **Co- PI(s):** Kamlesh K Meena, Ajay K Singh, Vanita Salunkhe, Sanjiv A Kochewad, Mahesh Kumar, Paritosh Kumar, Neeraj Kumar, Aliza Pradhan, Amresh Chaudhary, Himanshu Pathak



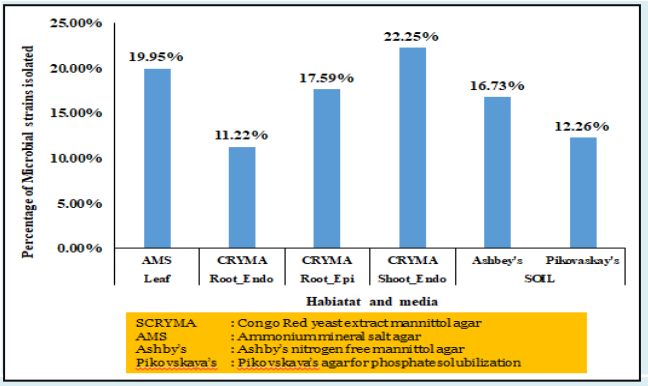
Outputs

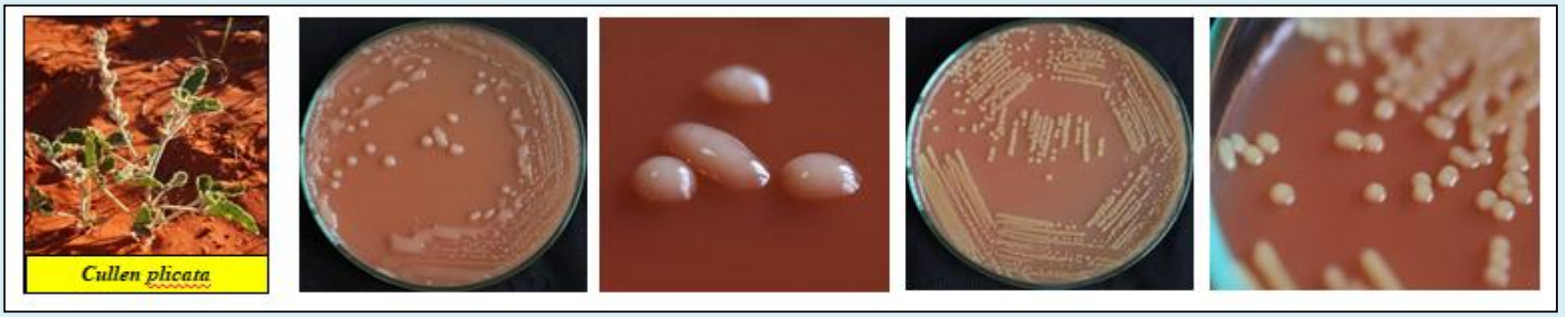
A) Microbial strains isolated from mangroves and sediments

- Isolation of a total of 58 bacterial morphotypes from coastal halophytic plant and sediment samples collected from Konkan region of Maharashtra.
- Obtaining isolates from endophytic environment of mangrove and a coastal creeper plant under high salt environment (~3.5% NaCl).
- Domination of root endophytes population among the isolated morphotypes.
- Obtaining nitrogen fixing bacterial strains from the rhizosphere sediment of mangrove.
- Most of the strains produced siderophores on iron deficient cultivation medium.
- Around 16% of the isolates were capable to produce exopolysaccharides.

B) Isolation of *Cullen Plicata* associated microbial strains

- Isolation of culturable bacteria from the phyllosphere of *Cullen plicata* growing in western Rajasthan.
- Obtaining a total of 66 bacterial morphotypes from different plant parts – rhizosphere soil, root, stem, and leaves on different media.
- Inhabitation of Cullen plicata leaves by fast growing pink-pigmented facultative methylotrophic (PPFM) bacteria, that occupied 19.95% of the total isolated morphotypes.
- More than 33% of the isolated strains belonged to endophytic environment in shoot and roots that indicated active plant-microbial interactions under harsh environmental conditions.





FP 4. Technology targeting and policy

Targeting prospective technologies for abiotic stress resilience in rainfed and dryland regions

PI: Dhananjay D Nangare, **Co- PI(s):** Sachinkumar S Pawar, Sanjiv A Kochewad, Bhaskar B Gaikwad, Boraiha K M, Kartikeyan N, Rajkumar, Mukeshkumar P Bhendarkar, K Ravi Kumar, Himanshu Pathak

Outputs

- Successful inauguration of "Krushik 2021" at ICAR-NIASM on 18th January, 2021.
- Development of ATIC , demonstration of different technologies, dragon fruit orchards, field experiments on farming system, alternative crops, genetic garden, livestock and fisheries farm, medicinal garden, QR-NIASM to more than 3000 farmers during Agriculture Technology Week (18-24 January, 2021).
- Two fortnightly agro advisories published on the Institute's website for stakeholders (English & Marathi versions).

Targets for next month

- Preparation of questionnaires; fish rearing in small farm ponds; development of ATIC.
- Compilation of ITK's for abiotic stress resilience in agriculture, livestock and fisheries.

Visit of farmers to ATIC, ICAR-NIASM

B) School of Water Stress Management (SWSM)

1. Mitigating water stress effects in vegetable and orchard crops

PI: Goraksha C Wackchaure; **Co -PI(s):** Dhananjay D Nangare, Satish Kumar, Aliza Pradhan, K M Boraiah, Pratap S Khapte, Jagadish Rane

Foliar application of growth regulators (PGR) in okra.

Outputs

- Field trial to study interactive effect of different sulphur sources and water stress in onion (cv. Bhima Kiran) using line source sprinkler system.
- Field trial to study interactive effect of bioregulators and water stress in Okra (cv. Singhum) using LSS.
- Measurement of real time growth parameters for onion and okra.

Targets for next month

- Foliar application of growth regulators and measurement of real time water, soil and crop growth parameter measurement in field experiment of onion and okra.

2. Exploring cropping system approaches for enhanced water productivity and income: Evaluating performance of soybean based cropping systems in response to deficit irrigation

PI: Aliza Pradhan; **Co-PI(s):** Jagadish Rane, Amresh Chaudhary

Outputs

- Harvesting and threshing of pigeon pea.
- Analysis of data of soybean, maize and pigeon pea on growth, canopy temperature and system productivity.
- Soybean crops under soybean + maize intercropping exhibited cooler canopy compared to sole soybean and Soybean + pigeon pea during flowering whereas during pod filling, soybean plants under soybean + pigeon pea intercropping showed the coolest canopy temperature.
- With respect to crop physiological parameters, yield attributing parameters, soybean equivalent yield and crop water use efficiency, soybean pigeon pea intercropping had significantly higher values than soybean + maize and sole soybean .

Targets next month

- Recording of yield attributing parameters and harvesting of sunflower.

Field view of soybean based cropping system

EAP 1. Genomics strategies for improvement of yield and seed composition traits under drought stress conditions in soybean (Funded by: ICAR-NASF)

PI: Ajay Kumar Singh; **Co-PI(s):** Mahesh Kumar, Jagadish Rane

Outputs

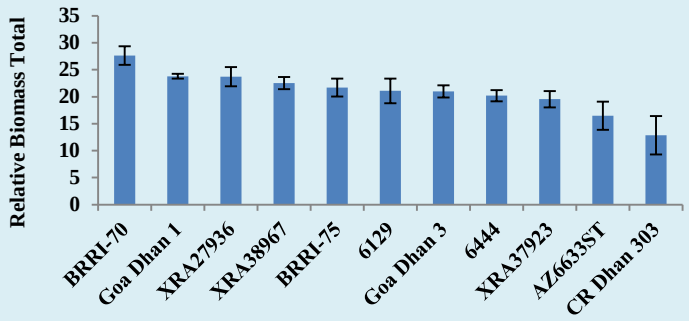
- Growing of soybean genotypes (100 in no.) in green house for traits associated with adaptation to drought stress.
- Extraction of total RNA from 30 soybean genotypes exposed to drought and also no stress.
- Synthesis of cDNA and checking expression of housekeeping gene β-Tubulin for equal amount of cDNA in gene expression profiling study.
- Searching of the coding sequence of 5 negative regulators (genes) from gene bank database in order to initiate construct designing for silencing genes to validate their roles in drought stress response.

Targets for next month

- Root system architecture profiling of 50 soybean genotypes using *in vitro* technique.
- Initiation of construct designing for silencing 5 negative regulators for rapid validation of their role in stress response in soybean.
- Standardization of transformation protocol for generating RNAi plants in soybean using cotyledonary node explants.
- Evaluation of 100 soybean genotypes for traits associated with water logging tolerance.

EAP 2. Climate smart management practices (Funded by: IRRI)

PI: Mahesh Kumar; **Co-PI(s):** Jagadish Rane, Amresh Chaudhary, Himanshu Pathak



Relative crop biomass of different rice genotypes

Outputs

- Optimization of method to quantify effect of weed on crop biomass in phenomics.
- The method will be helpful in identifying rice genotypes with better crop biomass that possibly help in competing with weed.

Targets for next month

- Identification of rice genotype with better Zn response under DSR.

EAP 3. Conservation agriculture for enhancing resource-use efficiency, environmental quality and productivity of sugarcane cropping system (Funded by: CA Platform ICAR)

PI: Goraksha C Wakchaure **Co-PI(s):** Aliza Pradhan, Amresh Chaudhary, Paritosh Kumar, Himanshu Pathak

Outputs

- Data Recording of real time growth parameters and irrigation for tillage and planting system in sugarcane.
- Frontline demonstration of SORF machine in sugarcane ratoon management in farmers fields of Gunavdi village, Baramati (> 50 farmers participated).
- Frontline demonstration of SORF machine in Krushik 2021.

Targets for next month

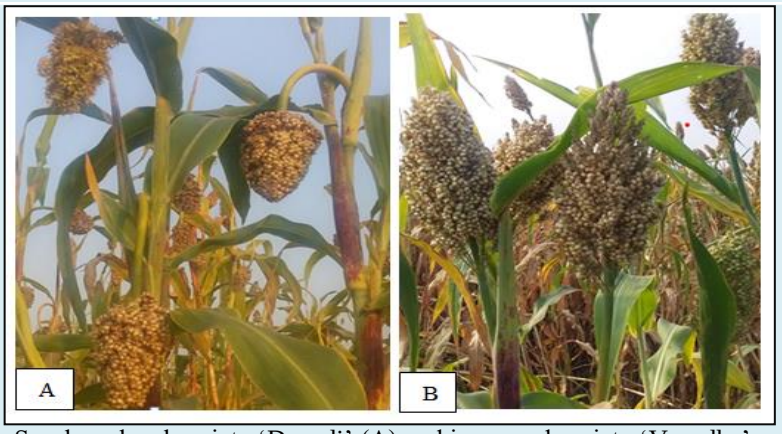
- Recording of real time growth and field parameters of sugarcane trials in plot no.B1, A2, B3 and A1a.
- Plantation of sugarcane seedlings in plot no. A1b and application fertilizer and irrigation treatment through sub-surface irrigation system.
- Demonstration and field trials of SORF machine at the farmers' fields for improving yields and productivity of ratoon sugarcane.

Demonstration of SORF at Gunavdi village

Demonstration of SORF during Krushik 2021

Rhizosphere Microflora Induced Tolerance Against Drought Stress in Sorghum

Pravin B. Taware , Sr. Technical Officer (Farm)



Sorghum local variety 'Dagadi' (A) and improved variety 'Vasudha' (B) exhibiting different morphological variations in panicle

Drought stress is a challenging issue for crop production problems in arid and semi-arid regions of the world. The drought stress negatively influences morphological and yield-related traits and also has effect on relationships between morpho-physiological traits in sorghum. (Sarshad et al. 2021). In this context, a brief overview on rhizosphere microflora induced tolerance against drought stress in sorghum is provided.

Santana et al. (2020) observed that the inoculation of different bacteria reduced some negative effects of water stress on sorghum. The nitrogen accumulation in the shoots was increased by all strains, suggesting their diastrophic ability even under drought. Kamali and Meharban (2020) reported a 27% increase in grain yield of sorghum due to co-inoculation of sorghum seeds with Nitroxin (a mixture of *Azotobacter* and *Azospirillum* sp.) and AMF (Arbuscular Mycorrhizal Fungi) in drought stress conditions by increasing the amount of photosynthetic pigments, soluble proteins and osmotic regulation and decreasing electrolyte leakage. Govindsamy et al. (2020) reported that rhizobacterial endophytes were successful, not only in providing better cellular osmotic adjustment in leaves (≥ 1-fold increase in proline accumulation over controls), but favorable physiological responses like Relative Water Content (RWC) and cell Membrane Stability Index (MSI) in the inoculated sorghum plants during the drought stress induction. Carlson et al. (2020) studied induction of systemic tolerance in sorghum against drought stress by screening a large collection of rhizobacterial isolates for their potential to exhibit this essential plant growth-promoting trait.

The underlying key metabolic changes in the enhanced drought stress tolerance observed in rhizobacteria-primed sorghum plants included (1) augmented antioxidant capacity; (2) growth promotion and root architecture modification as a result of the upregulation of the hormones gibberellic acid, indole acetic acid and cytokinin; (3) the early activation of induce systemic tolerance through the signalling hormones brassinolides, salicylic acid and jasmonic acid and signalling molecules sphingosine and psychosine; (4) the production of the osmolytes proline, glutamic acid and choline; (5) the production of the epicuticular wax docosanoic acid and (6) ACC deaminase activity resulting in lowered ethylene levels. These results unravelled key molecular details underlying the PGPR-induced systemic tolerance in sorghum plants, providing insights for the plant priming for abiotic stress.

Reference:

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Foldscope: An Economic Scientific Tool

- Komal Ramchandra Pawar , SRF (NICRA), SWSM

Foldscope, a low cost optical microscope developed by Dr. Manu Prakash and his team at Stanford University. It is an origami based paper microscope assembled from sheet of paper and lens. Its magnification ranges from 140X to 2000X. Foldscope is very cheap and cost effective as its cost less than ₹200.

Foldscope is a portable microscope which can survive in harsh field conditions. It has wide range of application in agriculture to study pollen morphology, pollen viability and pollen germination in different crops. The advantage of the study is that the samples can be processed at the field and observed instantly using foldscope in the field conditions without disturbing the samples.

It attracts and increases interest of students, teachers, scholars and scientist as well due to its unique characteristics. It has major advantage in increasing the scientific quest of students as it is easily accessible to everyone. Foldscope can be widely used efficiently in different scientific fields and can be made more accurate for its application in economically challenged regions.

A view of Foldscope instrument and use

"Agriculture is a fundamental source of national prosperity".

-J J Mapes