June
2021

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ICAR

राअस्ट्रैप्रसं
NIASM

Project Coordinator

.... a monthly update

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

Project Coordinator

.... a monthly update

Issue 12 **June 2021** **Page 02**

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 June, 2021 and targets for July, 2021. We made progress in research and development efforts particularly in 1) genomics, genetic and molecular approaches to improve water stress tolerance in soybean, 2) optimization of a HPLC mobile-phase combination from the newly developed bio-formulation, 3) recording of yield data of different fruits, 4) sowing of different *kharif* crops, 5) recording of comparative status of water consumption in different breeds of goat for the month, 6) measurement of the real time post-harvest quality parameters of okra, 7) recording of real time growth parameters in sugarcane, and 8) semi-quantitative estimation of siderophore production by the halotolerant bacterial morphotypes.

We observed 'World Environment Day' on June 5, 2021with a digital talk on "The Indian Savanna: Conservation of Grasslands in India" by Dr. Abi T. Vanak, Ashoka Trust for Research in Ecology and the Environment (ATREE), Bangalore, India, where the extent of the savannah ecosystem in India, species compositions, various drivers of habitat destructions, and possible efforts to conserve fragile ecosystems. The institute also organized farmers' awareness campaign on balanced use of fertilizers on June 18, 2021. Besides, 11th Institute Research Council (IRC) meeting was held on June 22, 2021 where the achievements of the institute during the past year, progress and targets of all the projects followed by inviting suggestions from the resource persons for further improvement in the research programme. 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)

Contents

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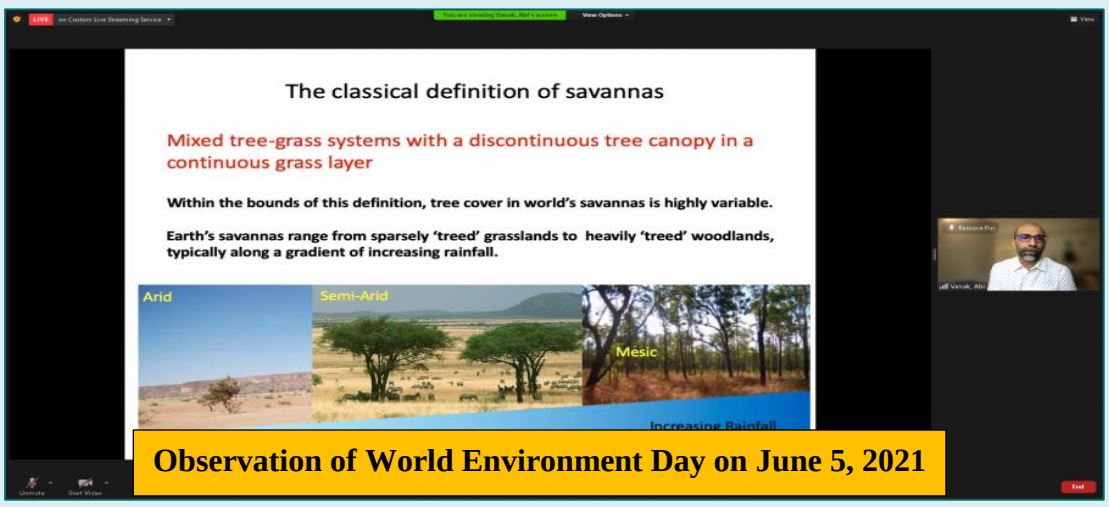
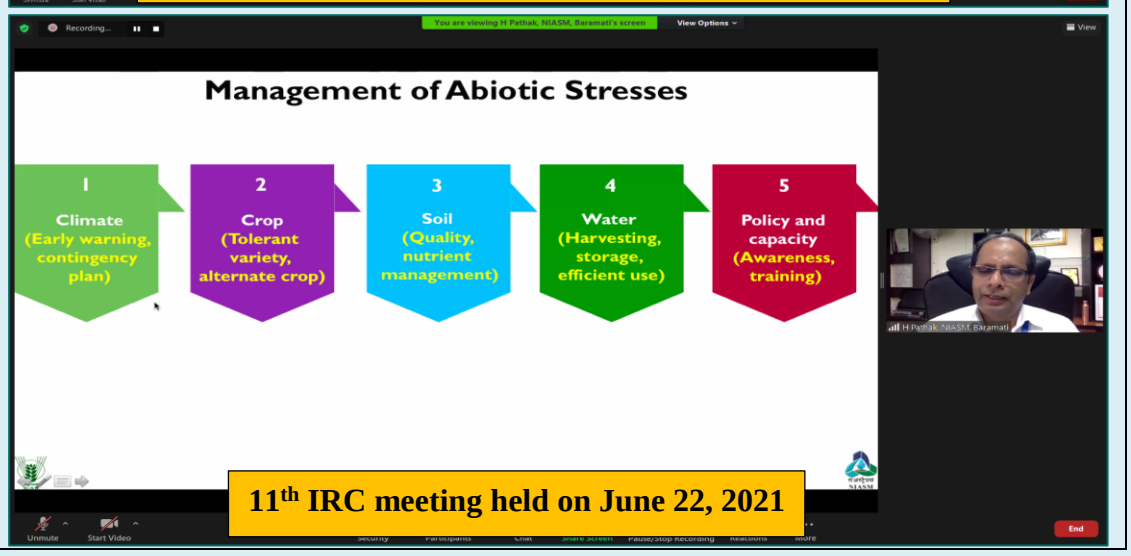


Observation of World Environment Day on June 5, 2021

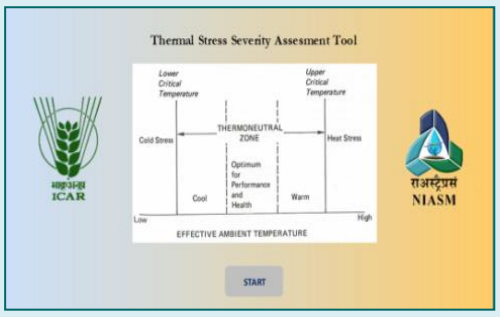


11th IRC meeting held on June 22, 2021

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 and Pravin H More



Thermal stress severity assessment tool

Outputs

- Development of web-scrapping scripts for extracting village-wise soil fertility datasets from open data sources.
- Extraction and arrangement of soil fertility pertinent datasets for state of Maharashtra.

Targets for next month

- Creating spatial maps of soil fertility (EC, pH, macro and micro nutrients) for states of Maharashtra and Madhya Pradesh.

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, Bhojaraja Naik, Gurumurthy S, Pravin B Taware, Aniket More, Rushikesh Gophane and Lalit Kumar Aher

Outputs

- Updated information of Co-PI and activities in RPP-I (added Dr. Bhojaraja Naik and Dr. Gurumurthy as Co-PIs).
- Germplasm of foxtail millet (118 accessions) and finger millet were sown (screening under nutrient poor soil condition).

Targets for next month

- Sowing of germplasm of groundnut (174 accessions).
- Sowing of varieties of different crops to establish crop cafeteria.
- Identification of drought responsive genes using GenBank database for gene expression profiling study in promising, wild-relative/lad races of Brinjal.
- Primer designing for gene expression profiling in wild-relative/land races of Brinjal.

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 and Avinash V Nirmale

Outputs

- Recording of flowering and fruit set in guava orchard (K7 plot) under different treatments.
- Collection of the fruit yield data of Sapota under different planting treatments.
- Measurement of post-harvest parameters viz., fruit weight, TSS and firmness of sapota.
- Preparation of technology data repository for pomegranate and publication of technology folder on pomegranate.
- Pit filling with potting mixture 3:2:1 (native soil: black soil: FYM) for sandal wood plantation.

Targets for next month

- Water budgeting of whole NIASM farm.
- Record physiological parameters, flowering and fruit set in guava orchard (K7 plot).
- Post-harvest analysis and compilation of data of sapota under different planting and soil treatments
- Planting of sandal wood and lemon grass in tamarind orchards.
- Survey visit to farmer's dragon fruit orchards.
- Prepare the technology data repository for each fruit crops/plots in the north block.

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 and Patwaru Chahande


Analysis of soil samples

Outputs

- Sowing of mungbean and pearlmillet.
- Procurement of seed material and fertilizers for *kharif* season.
- Plantation of perennial fodder crops in borders.
- Collection and analysis of soil samples.

Targets next month

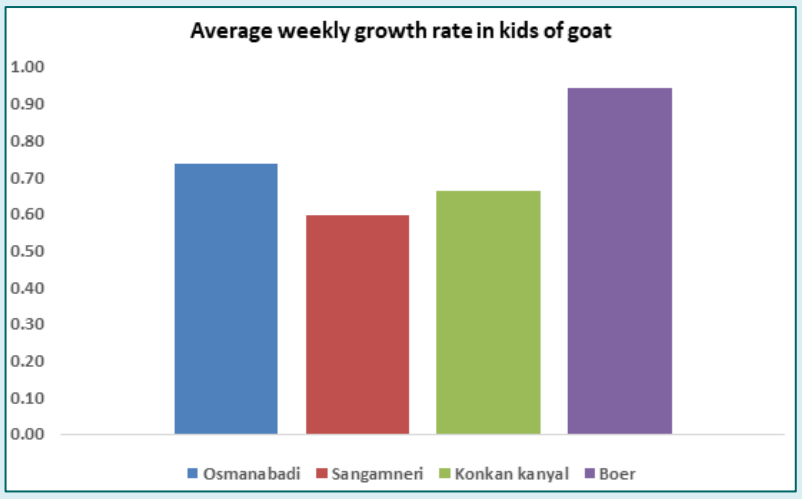
- Sowing of pigeonpea, sorghum and blackgram.
- Setting up of vermicompost unit.
- Weeding and other intercultural operations.


Sowing of pearl millet

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 and Sunil V Potekar



Outputs

- Recording of comparative status of growth, physiological and haematological parameters in different breeds of goat for June.
- Recording of temperature stress status in Vanaraja birds and different goat breeds for June month.
- Collection of inland saline water (9 ppt) from farmers' field for experiment on salinity stress.
- Procurement of set up for mass culturing of black soldier fly.

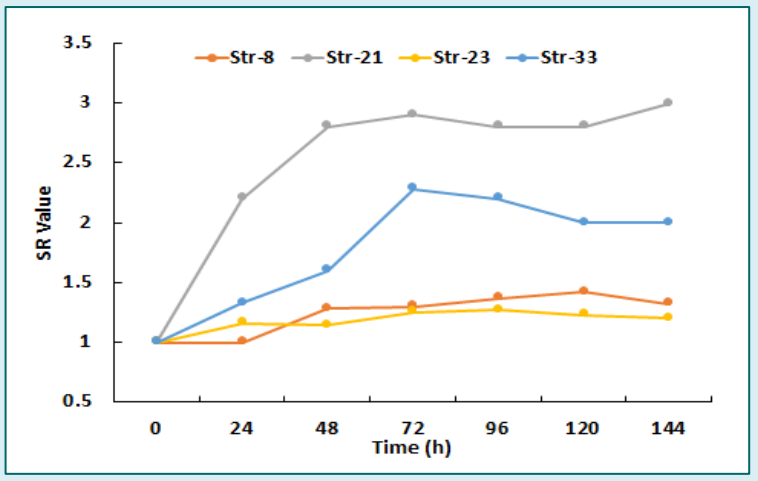
Targets for next month

- Evaluation of comparative DM digestibility in different breeds of goats in addition to recording different growth, physiological, haemato-biochemical parameters.
- Mass Culture of BSF work.
- Short and long term experiment on impact of salinity stress in GIFT Tilapia.
- Analysis of data collected for pre-monsoon season.
- Procurement and programming of microcontroller and sensors for monitoring abiotic stress in livestock.

FP 2. 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):** Ajay K Singh, Vanita Salunkhe, Sanjiv A Kochewad, Mahesh Kumar, Paritosh Kumar, Neeraj Kumar, Amresh Chaudhary and Himanshu Pathak



Siderophore production behaviour by the representative halotolerant PGPR isolates

Outputs

- Semi-quantitative estimation of siderophore production by the halotolerant bacterial morphotypes.

Targets for next month

- To standardize plant DNA extraction process.
- To draft a plan-of-implementation for survey and collection of samples.

FP 3. 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 and Himanshu Pathak

Outputs

- Preparation of the draft of questionnaire for survey of farmers regarding facing abiotic stress in crops and livestock.
- Review of research work, literature, and secondary data on indigenous technical knowledge resources available for compilation specifically on Abiotic stress management.
- Publication of two fortnightly agro advisories on institute website for stakeholders.
- Visit of medical practitioners from Baramati taluka to ATIC.

Targets for next month

- Preparation of online survey data collection format for the project.
- Coordination of extension activities.
- Collection of information on ITKs related to abiotic stress management.
- Writing of review paper /book chapter on abiotic Stress Management and role of extension and policy.

Visit of medical practitioners from Baramati taluka to ATIC

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 Singh Khapte and Jagadish Rane

Post-harvest quality estimation okra

Outputs

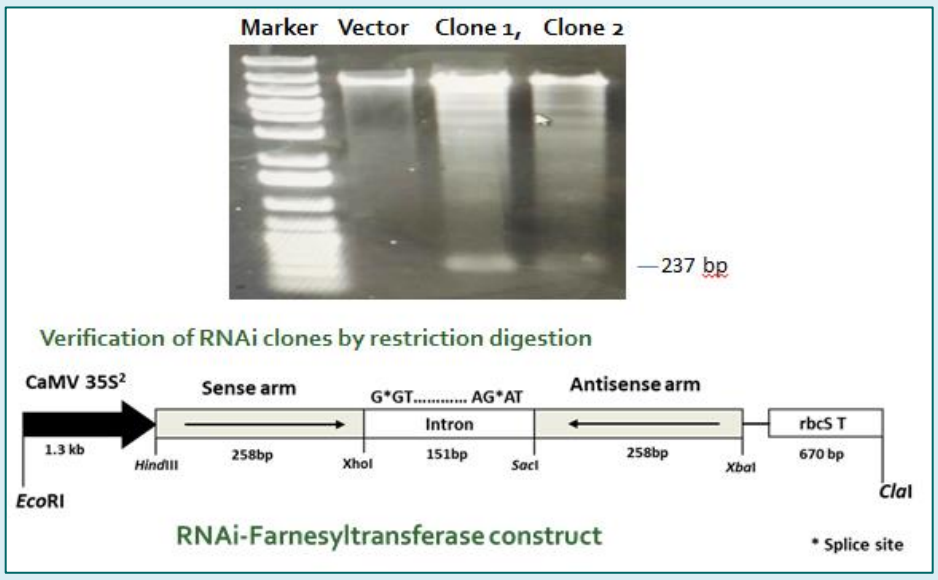
- Assessed the interactive effect of Sulphur and water stress on post-harvest storage quality of onion.
- Measurement of the yield and physico-chemical quality attributes of sapota.
- Compilation and analysis of yield, water productivity and firmness data of okra.

Targets for next month

- Measurement of the real time post-harvest quality parameters of onion treated with different sulphur sources under water stress conditions.
- Study of the interactive effect of bio-regulators and soils on bud development, flowering and fruit developments of dragon fruit.

2. Genomics, genetic and molecular approaches to improve water stress tolerance in soybean and wheat

PI: Ajay Kumar Singh



Outputs

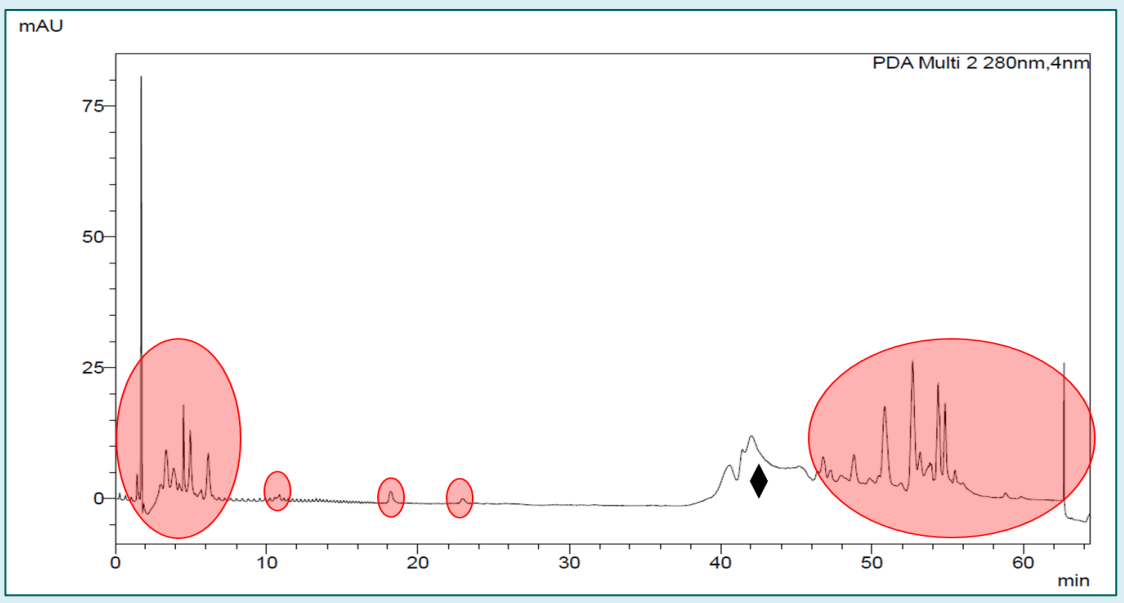
- A 237 bp sense and antisense fragment of wheat Farnesyltransferase gene was cloned to construct RNAi vector. Cloning of antisense fragment was verified by restriction digestion.

Targets for next month

- Cloning of soybean and wheat Farnesyltransferase RNAi cassette into pCAMBIA 1301 vector by using Gibson cloning strategy.
- Gene expression profiling in 15 promising soybean genotypes using Real-Time PCR.

EAP 1. Evaluation of halotolerant rhizobium and PGPB based biomolecules for alleviation of drought and salt stress (Funded by: AMAAS, NBAIM, Mau)

PI: Satish Kumar; **Co-PI:** Goraksha C Wackchaure



HPLC-signature chromatogram of the newly developed bio-formulation generated in acetonitrile based mobile phase. Peaks highlighted by red circles indicate a separated moiety; while the diamond indicates need of further resolution.

Outputs

- HPLC gradient-elution conditions with the acetonitrile-based mobile phase combination was used to generate the HPLC-signature of the newly developed bio-formulation.

Targets for next month

- To present the significant findings in annual review meeting organized by the nodal center.
- To prepare final technical report for the period 2017-2021.

EAP 2. Genomics strategies for improvement of yield and seed composition traits under drought stress conditions in soybean (Funded by: ICAR-NASF)

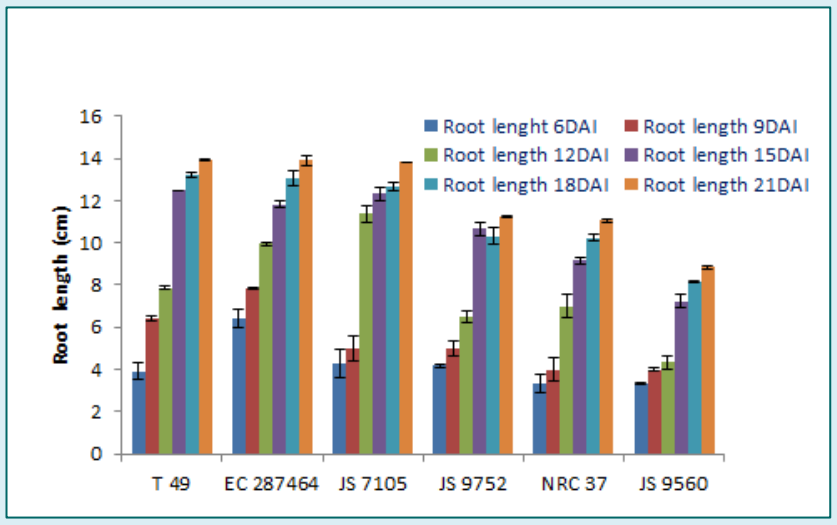
PI: Ajay Kumar Singh; **Co-PI(s):** Mahesh Kumar and Jagadish Rane

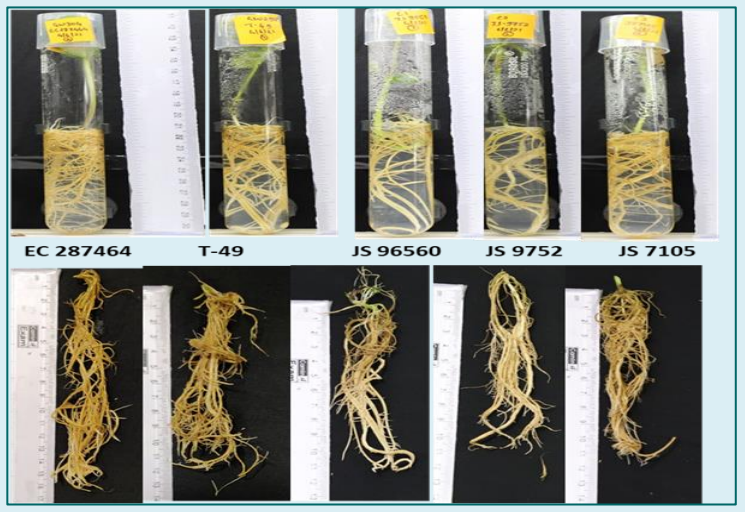
Outputs

- Soybean genotypes EC-287464 and T-49 showed longer roots with higher biomass compared to check varieties JS-9752, JS-7152 and JS-9560.

Targets for next month

- Evaluation of 100 soybean genotypes for traits associated with water stress tolerance.
- Root system architecture study in 100 soybean genotypes under *in vitro* condition.





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 and Himanshu Pathak

Distribution of inputs to SC beneficiaries under CRP-CA

Outputs

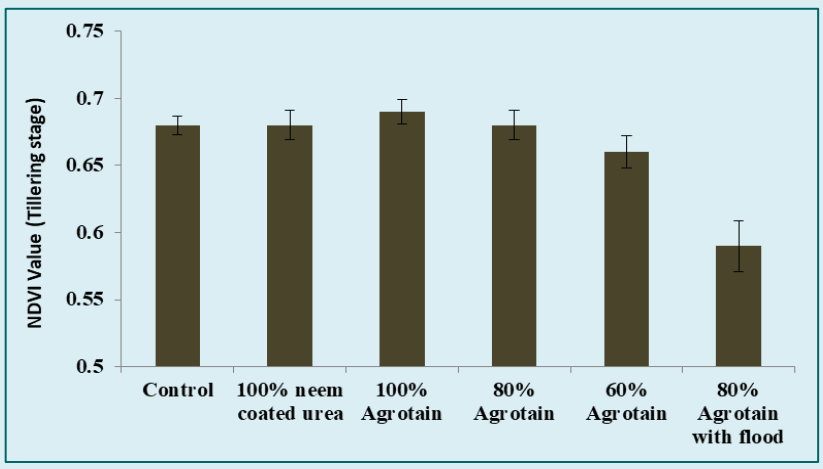
- Analysis of the fraction of organic carbon and nitrogen from soil samples under different treatment.
- Recording of real time growth parameters of sugarcane field experiments.
- Publication of the bulletin on work carried in last five years on conservation agriculture for sugarcane.
- Distribution of sugarcane juice extractor and chilli powder making machines to SC beneficiaries under CRPCA-SCSP.

Targets for next month

- Fractional analysis of phosphorus and potassium in soil samples of different CA treatments.
- Groundnut harvesting under experimental trial on optimising planting system, crop residues and irrigation management.
- Collection of soil samples to study the impact of groundnut intercropping on sugarcane system.
- Recording of real time growth parameters of sugarcane field experiments.

EAP 4. N-(n-butyl) Thiophosphoric Triamide (NBPT) as a urease inhibitor for improving nitrogen use efficiency in sugarcane cropping systems in India (Funded by: CIMMYT)

PI: Aliza Pradhan **Co-PI(s):** Amresh Chaudhary, Jagadish Rane, Pravin B Taware and Himanshu Pathak



NDVI value of sugarcane at tillering stage

Outputs

- Measurement of NDVI under different treatments.

Targets for next month

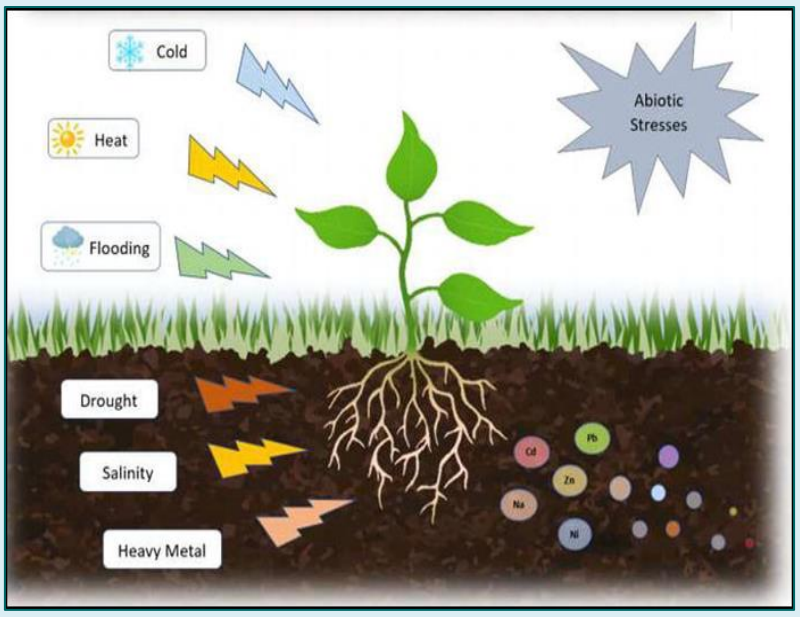
- Treatment application followed by soil sampling and analysis.
- Preparation of project update for the upcoming review meeting.

Root System Architecture in Sustainable Crop Production under Abiotic Stress Conditions-II

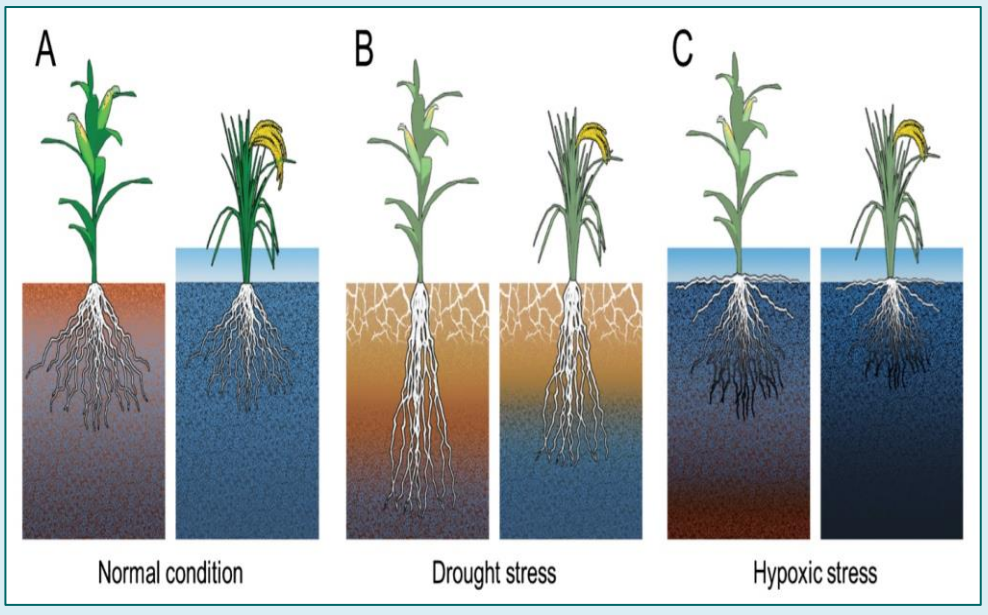
Pravin B. Taware , Sr. Technical Officer (Farm)

Roots are generally subject to more abiotic stress than shoots. Therefore, they can be affected by such stresses as much as, or even more, than above ground parts of a plant. Roots have functions such as connecting the plant to the environment in which it grows, uptake of water and nutrients and carrying them to the above-ground organs of the plant, secreting certain hormones and organic compounds, and thus ensuring the usefulness of nutrients in the nutrient solution. Roots also send some hormonal signals to the body in stress conditions such as drought, nutrient deficiencies, salinity, to prevent the plant from being damaged, and ensure that the above-ground part takes the necessary precautions to adapt to these adverse conditions. Salinity, drought, radiation, high and low temperatures, heavy metals, flood, and nutrient deficiency are abiotic stress factors and they negatively affect plant growth, productivity and quality. Given the fact that impending climate change increases the frequency, duration, and severity of stress conditions, these negative effects are estimated to increase. Kul et al., 2020 reviewed to show how abiotic stress conditions affect growth, physiological, biochemical and molecular characteristics of plant roots. When rainfall is scarce, continued water evaporation from the soil surface results in drought conditions. Relative to the root system architecture (RSA) suitable during normal conditions, a deeper RSA may be more advantageous under drought conditions brought about by drying from the soil surface.

In extreme submergences, such as catastrophic floods, the roots can act as an anchor to prevent a plant from being washed away. When flooding occurs from extensive precipitation such that water covers the soil surface, field crops will experience stress disorders, such as root rot caused by hypoxic stress. In this case, rooting on the soil surface and/or adventitious rooting around the topsoil may be an effective RSA to avoid hypoxic condition (Pedersen et al., 2021). Roots are highly able to perceive the physicochemical constraints of the soil and adjust its development accordingly, so it has an important impact of maintaining the nutritional and signal functions of the plant under abiotic stresses. Understanding the impact of stress conditions on root growth, development, and architecture may offer opportunities for genetic manipulations. The increase in root branching and root hairs in plants can increase yield while reducing the need for heavy fertilizer application by enabling plants to use available soil nutrients more efficiently and increase stress tolerance (Uga, 2021).



Abiotic stress sources affecting root and shoot growth of plants (Kul et al. 2020)



Schematic models promising ideotypes of RSA adapted to water stresses in maize and rice (Uga 2021)

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- Pedersen, O., Sauter, M., Colmer T. D. and Nakazono, M. 2021. Regulation of root adaptive anatomical and morphological traits during low soil oxygen. New Phytol. 229: 42–49.
- Uga, Y. 2021. Challenges to design-oriented breeding of root system architecture adapted to climate change. Breeding Science 71: 3–12. Doi:10.1270/jsbbs.20118.

"Look deep into nature, and then you will understand everything better".

-Albert Einstein