





# **Project Coordinator**

### .... a monthly update



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



Issue 23

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#### May 2022

#### 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 May, 2022 and targets for April, 2022. We made progress in research and development efforts particularly in 1) developing an interactive web based framework (beta version) of soil information system of ASIS, 2) collection and conservation of different stress tolerant crop germplasms, 3) recording of various trait observations in mutant lines of quinoa and chia, 4) recording of physical and chemical parameters of sapota, guava and grapes 5) sunburn and canopy management in dragon fruit, 6) recording of comparative hematological status in different breeds of goat for the month, 7) molecular characterization of stem canker (*Neoscytalidium dimidiatum*) pathogen in dragon fruit,8) harvest of sugarcane with measurement of cane and trash yield and other yield attributes as well as soil sample collection for chemical and biological analysis,



9) measurement of yield and its attributes for okra and eggplants, 11) study of drought adaptive traits of soybean genotypes, 12) establishment of ration eggplant experiment and 13) acclimatization study of cold water fish Mahaseer in fisheries wet laboratory.

Besides the research activities, some important events and extension activities were organized during the month of May. A five days training on "climate smart agriculture" was also organized for syngenta trainees in collaboration with Syngenta Foundation, India, Environmental Defence Fund, and ICAR-NIASM from May 16-21, 2022 at ICAR, NIASM.

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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#### **Contributors**

Principal Investigators & Co-Principal Investigators of all the projects

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#### **UMBRELLA PROJECTS**

#### **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): Himanshu Pathak, Amresh Chaudhary, Ram N Singh, Dhananjay D Nangare, Nitin P Kurade, Sachinkumar S Pawar, Mukeshkumar P Bhendarkar, Gopalakrishnan B, Sunil V Potekar, Pravin H More



#### Outputs

Interactive web based framework (beta version) of soil information system of ASIS.

#### **Targets for next month**

- Add compiled and processed data layers on ASIS webserver.
- Add interactive functions (filtering/search/expression builder) and visualization tools to ASIS.

Abiotic Stress Information System for India

#### **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

- Processing, labelling & storage of seeds of foxtail millet (118), finger millet (77), & ground nut (181) accessions; gene bank activities.
- Transplanting of wild brinjal species for physiological characterization under drought condition.

#### **Targets for next month**

• Sowing of germplasm/accessions of crops for multiplication maintenance; sowing of abiotic stress tolerant varieties of kharif crops

#### **UP3. 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 Wakchaure, 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, Rajagopal V, Hanamant M Halli, Pravin B Taware, Rushikesh Gophane, Noshin Shaikh, Santosh Pawar and Avinash V Nirmale

#### **Outputs**

- Irrigation scheduling as per deficit irrigation treatments in pomegranate; molecular characterization of stem canker (Neoscytalidium dimidiatum) pathogen in dragon fruit; sunburn management in dragon fruit throughDifferent colour shade nets (Green, black and white) having different shade factor (35 and 50%) & recording of light intensity, PS II, NDVI, Total chlorophyll, moisture and sun burn percentage.
- Analysis of fruit quality parameters (phenols, flavonoids, total antioxidants, proline, MSI and physical parameters) of sapota planted with different planting techniques and filling mixtures.
- Recording of yield and quality parameters of Karonda including (phenols, flavonoids, and total antioxidants) and time required from flower bud initiation to fruit harvesting; extraction of essential oil from lemon grass which ranged from (1.20 to 1.75) %.



Karonda (flower bud initiation to fruiting)

#### **Targets for next month**

- Post-harvest fruit quality analysis of sapota, grapes and guava.
- Irrigation scheduling in pomegranate as per deficit irrigation treatments.
- Harvesting of lemongrass; sunburn and canopy management experiment in dragon fruit.
- Evaluation of antifungal potential of essential oils (EOs) against Neoscytalidium dimidiatum.

#### **UP 4. Climate-smart IFS (CIFS)** Climate resilient integrated farming system in semi-arid region

PI: Sanjiv A Kochewad; Co-PI(s): Goraksha C Wakchaure, Vanita Salunkhe, Rajkumar, Mukeshkumar P Bhendarkar, Aliza Pradhan, Vijaysinha D Kakade, Sangram B Chavan, Rajagopal V, N Subash, Laxman R Meena, Pravin B Taware and Patwaru Chahande

#### Outputs

- Ploughing and harrowing followed by FYM application in black soil plots.
- Quantification of mango per tree; earthing up of cluster bean to avoid lodging.
- Visit of Syngenta trainee fellows to CIFS unit.

#### **Targets next month**

• Preparatory tillage operation for kharif season; planning of Mrig Bahar in pomegranate & quantification of vermicompost.



Ploughing of black soil after rabi season

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#### **FLAGSHIP PROJECTS**

#### 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, Bhaskar B Gaikwad, Gopalakrishnan B, Rajkumar, Dhananjay D Nangre, Avinash V Nirmale, Sanjiv A Kochewad



Physiological parameters of different goat breeds during May, 2022

#### Targets for next month

• Evaluation of stress parameters & parasitic prevalence in goat breeds; survey of goat farmers and haematological analysis of field and experimental goats; evaluation of breeding unit of BSF & mass culturing; evaluation of Azolla & Duckweed production performance per unit area

#### 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

#### Outputs

- Harvesting of quinoa and chia M2 populations to identify the desirable mutant types for flowering, branching, foliage color etc.
- Grouping of mutant lines based on the variations for growth and morphological traits compared to wild types.

#### Targets for next month

• Data compilation and analysis (M0, M1 & M2 generations); sowing of selected M2 plants.



Monitoring Quinoa and Chia M2 populations

#### **FP 3. Bio-saline Agriculture**

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

PI: Ajay K Singh; Co-PI(s): Vanita Salunkhe, Sanjiv A Kochewad, Mahesh Kumar, Paritosh Kumar, Neeraj Kumar, Amresh Chaudhary and Himanshu Pathak



#### Multiplication of halophytes

#### Outputs

- Multiplication of halophytic plants in both soilrite and black soil.
- Monitoring of growth and development of halophytes at 3-5% NaCl level.
- **Targets for next month**
- Multiplication of halophytic plants; salinity & water stress response in halophytes.
  - Isolation & characterization of microbiome associated with halophytes.
- Shoot and root anatomical studies of halophytes.

**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 and Himanshu Pathak

#### Outputs

- Organization of training as well as distribution of inputs to beneficiaries under TSP and SCSP program.
- Co-ordination of visit of farmers, state departments, students and FPO's (313 visitors) to ATIC/museum, research fields of ICAR, NIASM.

#### **Targets for next month**

- Field survey and data collection of farmers regarding biophysical and socio-economic constraints.
- Procurement and distribution of critical inputs to farmers under TSP and SCSP program.
- Coordination of extension activities and visits to NIASM.

#### **IN-HOUSE PROJECTS**

#### B) School of Water Stress Management (SWSM)

1. Mitigating water stress effects in vegetable and orchard crops

PI: Goraksha C Wakchaure; Co-PI(s): Dhananjay D Nangare, Pratap Singh Khapte, Aliza Pradhan, K M Boraiah, and Jagadish Rane

#### Outputs

- Measurement of biochemical traits such as phenol, flavonoids, total sugar and titratable acidity of sapota under different planting methods.
  Analysis of two years data of total pod yields, water productivity, biomass and harvest index of okra to study the interactive effect of plant
- Analysis of two years data of total pod yields, water productivity, biomass and narvest index of okra to study the interactive effect of plan bio-regulators and water stress using LSS.
- Establishment of ratoon trial of water stress tolerant rootstocks of eggplant.
- Initiation of short term course on abiotic stresses in agriculture: an introduction and hands-on training for skill development for students and young researchers (1 June to 10<sup>th</sup> July, 2022).

#### Targets for next month

• Measurement of antioxidant properties of sapota; measurement of real time soil-water-plant parameters of ration eggplants trial.



Post-harvest quality parameters of sapota



Short term course on abiotic stresses in agriculture

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

#### PI: Ajay Kumar Singh



Screening of soybean genotypes for root biomass

#### Outputs

- Evaluation of promising soybean genotypes along with check varieties JS-7105, JS-9752 and NRC-37 for proline content.
- Proline content significantly increased under drought stress condition as compared to no stress conditions.

#### Targets for next month

- Stomatal function studies in EIN2- silenced soybean plants under well watered and water deficit conditions.
- ABA quantification in EIN2-silenced soybean plants.

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#### EXTERNALLY-AIDED PROJECTS

EAP 1. 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



Outputs

- Delayed hydrolysis in Agrotain treated urea plots compared to urea plots.
- Maximum concentration of NH4+ -N in neem coated urea (NCU) plots just one day after fertilization followed by a decreasing trend indicates higher volatilisation loss of ammonia from NCU.
- Conc. Of NH4+ -N greater in AIU than that of NCU at 10 DAF.

#### Targets for next month

- Recording of NDVI at every 15 days interval.
- Application of treatments at pre-growth stage followed by soil sampling as per the objectives of the experiment.
- Analysis of soil samples for ammonium, nitrate and urease enzymes under different treatments.

NH4+ concentration (mg/kg) of soil in sugarcane

## EAP 2. 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

#### Outputs

- Analysis of growth, yield and soil fertility parameters of different field trial.
- Real time morpho-physiological parameters (plant height, plant tillers, NDVI, PS-II, hyper spectral, RWC etc) of standing sugarcane crop in different field experiments.
  Distribution of inputs under SCSP programme.

#### Targets for next month

• Data analysis of growth, yield and soil fertility parameters of different field trials under CRPCA.



Organization of one day training cum demonstration under CRPCA

## EAP 3. Genomics strategies for improvement of yield and seed composition traits in soybean under drought stress conditions (Funded by: ICAR-NASF)

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

#### Outputs

Evaluation of promising soybean genotypes along with GmEIN2-silenced and empty vector infected soybean plant along with check varieties JS-7105, JS-9752 and NRC-37 for drought adaptive traits like PS-II efficiency, canopy temperature and canopy greenness.
 Evaluation of these genotypes for GmEIN2 gene expression under no stress and drought stress conditions.

#### • Evaluation of these genotypes for GmEIN2 gene expression under no stress and drought stress conditions.

#### Targets for next month

- Expression profiling for EIN2 gene in in 18 promising soybean genotypes under no stress and water deficit conditions.
- Morphological, physiological and biochemical analyses of 18 promising soybean genotypes under no stress and water deficit conditions.



#### Brassinosteroid mediated stress tolerance mechanism in plants

#### Krishna Kumar Jangid (RA, NICRA) & Vinay Hegde (PhD student, PDKV, Akola)

Brassinosteroids (BRs) are growth promoting steroid hormones that were first isolated from Brassica pollen. It involves in regulation of various growth and developmental process of plant as well as in stress tolerance mechanism with signal transduction and cross talk between others stress response factors. Most bioactive form of brassinolide is 24-epibrassinolide and 28-homobrassinolide. During the response against abiotic stress, plant produce reactive oxygen species (ROS) which is harmful to cell organelles involve in damage to nucleic acids, proteins and cell membranes. For the protection of these cell organelles, BR signaling regulates the expression of BR target genes that are involved in the activation of antioxidant systems and metabolites (Choudhary et al., 2012). BR signaling pathway involves the glycogen synthase kinase-3, BIN2 (brassinosteroid-insensitive 2), which negatively regulates the transcription factors BZR1 (brassinazole-resistant 1) and BES1 (bri1-EMS-suppressor 1) by phosphorylating them while the phosphatase BSU1 (bri1 suppressor 1) positively regulates BR signaling possibly by dephosphorylating BZR1 and BES1 (Divi & Krishna 2009). BR signaling activates gene expression of the nicotinamide adenine dinucleotide phosphate (NADPH) oxidase to regulate H2O2 production to increase tolerance against stress condition. BR signaling can also be involved in production of nitric oxide (NO), which is a key promoter of abscisic acid (ABA) biosynthesis and plays a crucial role in stress tolerance. Interactions between BRs and ABA regulate stress tolerance by expression both ABA-induced stomatal closure and BR-induced ABA biosynthesis. According to singh et al., 1993, BR had significant increases in fresh and dry weight, number of tillers, stem thickness, root activity, and nitrate reductase activity in Cicer arietinum under water stress. BR enhanced chlorophyll accumulation, amylase activity, total protein contents, stomatal conductance, photosynthesis, and membrane stability and final yield under water stress conditions in various experiments.



BR signalling mechanism during stress condition to promote stress tolerance

As BRs control several important agronomic traits such as flowering time, plant architecture, seed yield and stress tolerance, the genetic manipulation of BR biosynthesis, conversion or perception offers a unique possibility of significantly increasing crop yields through both changing plant metabolism and protecting plants from environmental stresses.

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*"The world is not to be put in order. The world is in order. It is for us to put ourselves in unison with this order."*