December
2020

Project Coordinator

.... a monthly update

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

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From Director's Desk .....

New Year Greetings from ICAR-NIASM !!!

The current issue on project coordinator highlights the progress made under all the ICAR-NIASM projects during December, 2020 and targets for January, 2021. During the last month, project activities comprised of harvesting of *kharif* crops as well as field preparation and planning for *rabi*. In addition, data collection and analyses regarding effect of abiotic stress factors on crops, animals, fish and poultry, installation of automation systems, analysis of weather parameters, evaluation of germplasm traits to certain abiotic stresses, communications for institutional collaborations, preparation/ submission/publication of agro-advisory, technical bulletin, popular articles & research papers, etc. were completed. A visit to all field experiments was also conducted for better insight and understanding. The 'Insights from global research' section is encompassing information on "Wax biosynthesis in response to biotic and abiotic stress". 'A leaf from history' features principles of conservation agriculture. 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 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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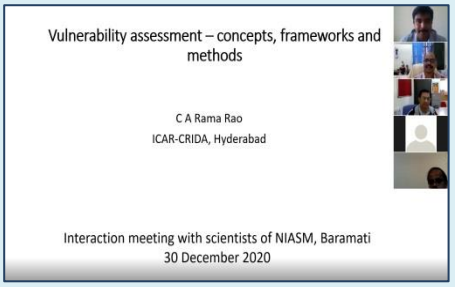
Visit to all Field Experiments of ICAR-NIASM

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



Online Interaction session on vulnerability assessment

Outputs

- Organisation of Online "Guidance and Interaction Session on Vulnerability Assessment" by experts from ICAR-CRIDA covering topics; a) Vulnerability assessment - concepts, framework and methods" by Dr. CA Rama Rao, Head, Section of Design and Analysis, ICAR-CRIDA. & b) "Construction of vulnerability scores & composite vulnerability index" by Dr. BMK Raju, PS (Agril Statistics), ICAR-CRIDA.
- Identification of edaphic and atmospheric stress indicators for preparing vulnerability index.
- Vulnerability analysis of meteorological parameters.

Targets for next month

- Identification of indicators for vulnerability of livestock.
- 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):** AK Singh, Basavaraj PS, Mahesh Kumar, Satish Kumar, Rajkumar, N Karthikeyan, Paritosh Kumar, Sanjeev Kochewad, MP Bhendarkar, Harisha CB, Pratapsingh Khapte, Jagadish Rane, Neeraj Kulakshetran, Pravin Taware, Aniket More, Rushikesh Gophane, Lalitkumar Aher

Transplanting of wild species of Brinjal

Outputs

- Transplantation of wild species (15) of Brinjal, few tomato and capsicum lines.
- Characterization of turmeric lines (16) is in progress.
- Weeding, fertilization, irrigation and other crop management practices in already sown crops.

Targets for next month

- Transplanting of saplings of two subabul genotypes.
- Standardization of grafting protocol for propagation of seedless subabul.
- Recording of observation on morpho-physiological traits in turmeric, safflower, chickpea, wheat and fenugreek.

UP 3. Model Green Farm (MGF)

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

PI: DD Nangare; **Co-PI(s):** H Pathak , GC Wakchaure, BB Gaikwad, Vanita Salunkhe, Rajkumar, Paritosh Kumar, Aliza Pradhan, Amresh Chaudhary, MP Bhendarkar, Sangram Chavan, Vijaysinha Kakade, PS Khapte, Pravin Taware, Rushikesh Gophane, Noshin Shaikh, Santosh Pawar, AV Nirmale

Stocking of GIFT seed in farm pond

Outputs

- Stocking of GIFT seed with different stocking densities in small farm pond.
- Establishment of dragon fruit seedlings in pot for pathogenicity study.
- Multiplication of Pathogenic fungi on Potato Dextrose Broth(PDB) for spore spray inoculation.
- In vitro evaluation of temperature re quirement of pathogenic fungi isolated from Dragon fruit in progress.
- Data collection on heavy rain events occurred in a day in last 15 years at Baramati.
- Monitoring the progress of work of LIS and installation of automation system at farm.

Targets for next month

- Installation of drip system for sandalwood plants.
- Survey of dragon fruit orchards on the farmer's field.
- In vitro evaluation of temperature requirement of pathogenic fungi isolated from Dragon fruit.
- Diagnosis of leaf spot in Sapota.
- Monitoring the progress of work of automation system to be installed in the field.

UP 4. Climate-smart IFS (CIFS)

Climate resilient integrated farming system in semi-arid region

PI: Sanjiv A Kochewad; **Co-PI(s):** KK Meena, GC Wakchaure, Vanita Salunkhe, Rajkumar, MP Bhendarkar, Aliza Pradhan, Amresh Chaudhary, N Subash, Laxman Meena, Pravin Taware, Patwaru Chahande

Application of black soil on sides of farm pond

Outputs

- Completion of sowing in Sunflower and Safflower crop.
- Completion of weeding in chickpea and Jowar.
- Spraying of insecticide for controlling diseases in chickpea and Jowar.
- Transplantation of Sugarcane crop in control plot.
- Plantation of Teak on the borders as a part of agro-forestry component.
- Application of black soil on the sides of farm pond.
- Installation of drip irrigation for border horticulture plants.

Targets next month

- Laying of HDPE sheet in farm pond.
- Construction of multilayer structure.
- Sowing of Lucerne fodder crop in orchard.
- Plantations of remaining agro-forestry components.

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

Field experiment on IPM of fall armyworm in maize

Outputs

- Recording of comparative prevalence status of external parasites in all the goat breeds. Konkan kanyal breed showed higher prevalence.
- Collection of environmental parameters to access stress levels in poultry birds and assessment of thermal stress risks in poultry for December.
- Procurement and quarantine of Vanraja backyard poultry birds.
- Exposure of Experimental fish (GIFT tilapia) to three different salinity levels of 5, 10 and 15ppt.
- Initiation of field experiment on IPM of fall armyworm in maize.
- Collection and compilation of meteorological data.

Targets 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 and around Baramati in maize.
- 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

Exploiting under-utilised crops (ex. quinoa) for augmenting income in water scarce regions

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

Sowing of Quinoa

Outputs

- To create genetic variability in Quinoa and Chia through mutation the seeds of Quinoa and Chia (Black and white) were sent to ICAR-IIHR, Bengaluru for irradiation with 3 doses in each crop *viz.*, in Quinoa: Radiation intensity (Gy) of 150, 250 & 350 & in Chia, 400, 500 & 600, respectively).
- Study on germination and physiological effects/ damage on quinoa seedlings is under progress.
- Sowing of Quinoa (different date and method of sowing).

Targets for next month

- Observation/ data on germination and other physiological effects on seedlings to be recorded in Quinoa and Chia in field and lab/greenhouse conditions.

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):** Ajay K Singh, Vanita Salunkhe, Sanjiv A Kochewad, Mahesh Kumar, Paritosh Kumar, Neeraj Kumar, Aliza Pradhan, Amresh Chaudhary, Himanshu Pathak

High end computational server for big data analysis

Outputs

- A Preliminary survey of Costal saline habitats from Diweagar area of Raigad district (Konkan Region of Maharashtra).
- Collection of samples (Mangroves water, Mangroves plants, Mangroves marshy soil, Sea water) from the Deweagar of Raigad District for microbiological studies.
- EC value of the mangroves marshy soil ranged between 10.37 to 23.4 dS/m whereas EC value of the water from Mangroves fields and coastal sea ranged between 74.7-123 dS/m .
- Procurement of a high end computational server with 40 core processor and 256 Gb RAM for big data analysis .
- Currently the server has active application packages viz., anvi'o v6.2, SPAdes assembler, Bowtie2, Trimmomatics, Cutadapt, SAMtools.

FP 4. Technology Targeting and Policy

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

Team: Dhananjay D Nangare, Sachinkumar S Pawar, Sanjiv A Kochewad, Bhaskar B Gaikwad, Boraiha K M, Kartikeyan N, Rajkumar, Mukeshkumar P Bhendarkar, Himanshu Pathak

Outputs

- Analyzed data on perceptions of fisheries businesses, conducted through online survey during Covid Lockdown.
- Two fortnightly agro advisories published on the Institute's website for stakeholders (English & Marathi versions).

Targets for next month

- Preparation for Krushak 2021; Development of ATIC.
- Compilation of ITK's for abiotic stress resilience in agriculture, livestock and fisheries.

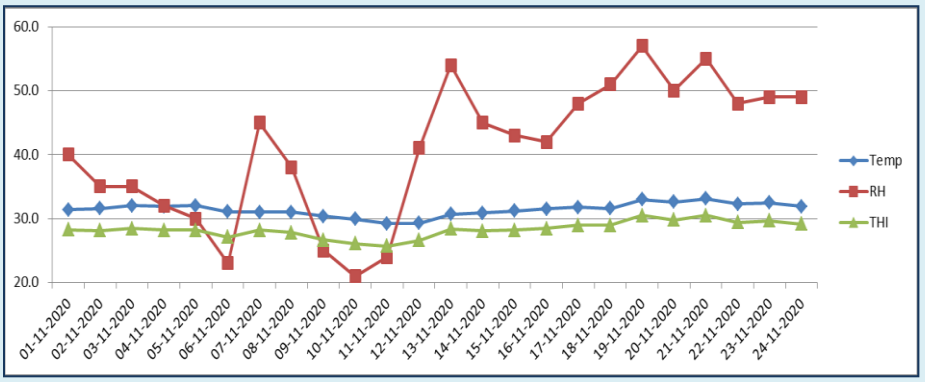
A) School of Atmospheric Stress Management (SASM)

1. Study of immune response and HSP genes polymorphism in relation to heat stress in poultry

PI: Sachinkumar S. Pawar; **Co-PI:** N P Kurade

Outputs

- Environmental parameters to access stress levels in poultry birds collected and assessed thermal stress risks in poultry for November month.
- The poultry shed prepared for next batch of birds and order placed for experimental birds.



Thermal stress levels in poultry

Targets next month

- Procurement of Vanaraja birds for experimentation.
- Amplification of Heat Shock Protein polymorphic region.
- Recording of environmental parameters to access stress levels in poultry.

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, Karthikeyan N, Jagadish Rane

Field trial to study interactive effect of different sulphur sources and water stress in onion

Outputs

- Field trial to study interactive effect of different sulphur sources and water stress in onion .
- Field trial to study interactive effect of bioregulators and water stress in Okra (cv. Singhum) using LSS.

Targets for next month

- 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, Karthikeyan N

Sowing of Sunflower

Outputs

- Gap filling, thinning and weeding in sunflower.
- Data analysis of harvested soybean and maize.

Targets next month

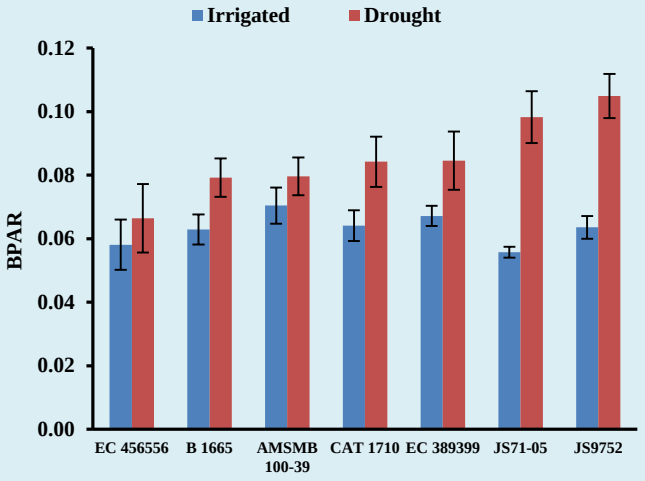
- Harvesting of pigeon pea.
- Sowing of mung bean.

"We have to transform India in five areas where India has core and competence First being Agriculture."

- ***Dr. A P J Abdul Kalam***

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



Boundary Point to Area Ratio

Outputs

- 50 soybean genotypes were phenotyped in Phenomics facility for traits associated with adaptation to drought stress.
- Soybean genotypes EC-456556 and CAT-1710 had higher digital biomass and lower Boundary Point to Area Ratio (BPAR) as compared to check varieties JS-7105 and JS-9752 when analysed using visible camera in phenomics.

Targets for next month

- Screening of 75 soybean genotypes in greenhouse for canopy temperature, NDVI, PS-II efficiency.
- RT-PCR analysis for gene expression profiling (20 drought responsive genes) in 40 soybean genotypes under withheld watering and also in no stress conditions.
- Sowing of wild-type genotypes and promising varieties of soybean.

EAP 2. Phenotyping of pulses for enhanced tolerance to drought and heat (Funded by ICAR-NICRA)

PI: Jagadish Rane; **Co-PI:** Mahesh Kumar

Outputs

- Initiation of experiment with chickpea genotype (24) to characterise under depleting soil moisture condition using IR, VIS and NIR sensors.
- Recording response of chickpea genotypes using different physio and biochemical parameters.

Targets for next month

- Phenotypic evaluation of chickpea genotype using phenomics.
- Characterization of chickpea genotypes in field condition.


Phenotypic evaluation of chickpea genotypes

EAP 3. Climate Smart Management Practices (Funded by: IRRI)

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


Experiment of Rice genotypes

Outputs

- Experiment reinitiated to understand the varietal role in rice weed competition.
- Standardization of concentration of Zn foliar application in rice under DSR.

Targets for next month

- Initiation of experiment with rice genotype (12) for Fe and Zn response under DSR.

EAP 4. 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):** Mahesh Kumar, Paritosh Kumar, Amresh Chaudhary, Aliza Pradhan, Himanshu Pathak


Recording of sugarcane growth parameters

Outputs

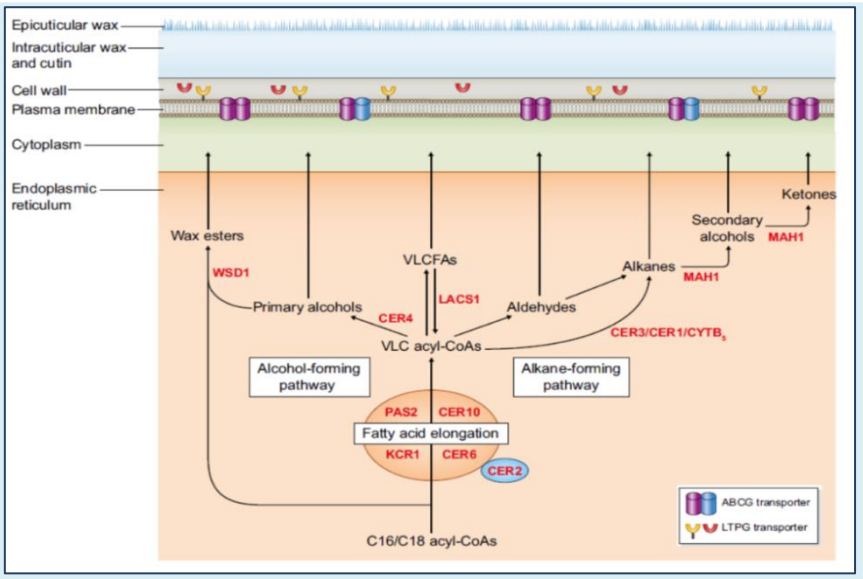
- Data recording of sugarcane growth parameters *viz.*, plant height, plant tillers, no. of internodes, diameter of internodes, length of internodes from Plot No. B1, A2 and B3.
- Application of treatment wise basal dose of fertilizer for nutrient management practices in plot A1a and split dose of fertilizer to plot no. B1, A2 and B3 .
- Weed management practices in plot no. B1 and A1a and Earthing up in plot no. B1.

Targets for next month

- Timely measurement of growth and physiological attributes of sugarcane from all the treatments .

Wax Biosynthesis in Response to Abiotic and Biotic Stress

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



Cuticular Wax Structure (Lewandowska et al 2020)

Reference:

Lewandowska M., Keyl A. and Feussner I. 2020. Wax biosynthesis in response to danger: its regulation upon abiotic and biotic stress. New Physiologist 227: 698-713 doi: 10.1111/nph.16571

Primary aerial surfaces of plants are covered with a cuticle, an extracellular hydrophobic layer that serves as the first line of defense against environmental threats. The cuticle primarily reduces transpirational water loss, and controls the exchange of solutes and gases between plants and their atmospheric surrounding. The cuticle can change in response to various abiotic or biotic stresses. It becomes thicker upon water deprivation to control nonstomatal water loss and permeability.

The plant cuticle is the first physical barrier between land plants and their terrestrial environment. It consists of the polyester scaffold cutin embedded and sealed with organic, solvent-extractable cuticular waxes. Cuticular wax ultrastructure and chemical composition differ with plant species, developmental stage and physiological state. Despite this complexity, cuticular wax consistently serves a critical role in restricting nonstomatal water loss. It also protects the plant against other environmental stresses, including desiccation, UV-radiation, microorganisms and insects. Lewandowska et al, 2020 reviewed current knowledge of wax biosynthesis and regulation in relation to abiotic and biotic stresses and stress responses.

The plant cuticle is an extracellular, hydrophobic barrier that protects plants not only from transpirational water loss, but also from high light intensity, drought, invading pathogens and insect herbivores. The capacity to synthesize cuticular lipids represents a fundamental morphological and physiological adaptation that contributed to the evolutionary success of plants during the transition from aquatic conditions to a desiccating terrestrial environment. They expresses the research needs to fully understand the relationship between wax morphology, coverage and chemistry in response to various abiotic and biotic stresses. In particular, the regulatory mechanisms controlling cuticular wax deposition in response to various stressors and the role of cuticle components as signaling molecules promoting the resistance or susceptibility of plants to biotic threats. This research will enable the development of cultivars with improved health, yield and quality, thereby promoting sustainable agriculture.

A leaf from History: The 3 Principles of Conservation Agriculture

- Prashant P Bhosale, YP-1, SSSM

It is a way of farming that conserves, improves, and ensures efficient use of natural resources. It aims to help farmers achieve profits with sustain production levels while conserving the environment. Three Principles of Conservation Agriculture:

Conservation tillage:

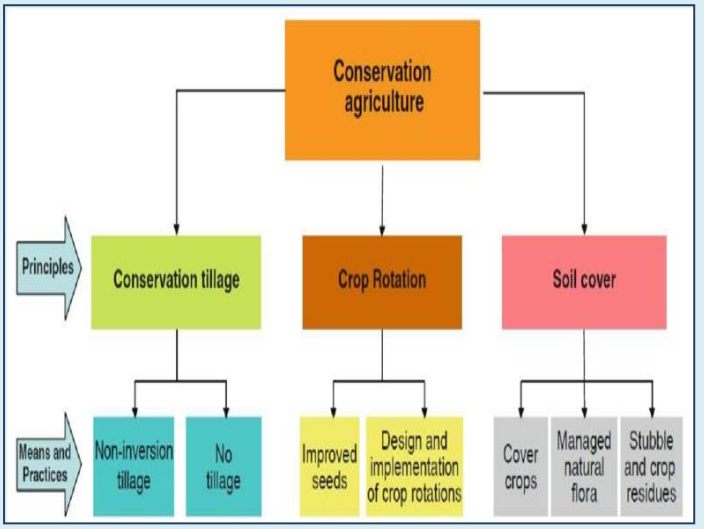
Only disturb the soil where the seed, fertilizer and manure are to be placed. Reduces destruction of the soil structure, does not expose soil to wind and water erosion, improves water infiltration rates, saves time, energy, and money because less land is tilled, reduces soil compaction because the crop plant roots are left undisturbed.

Crop Rotation:

Replenishes soil fertility: intercropping with nitrogen-fixing legumes adds 'top-dressing fertilizer' to the soil; enables crops to use the nutrients in the soil more effectively: helps to control weeds, diseases and pests by breaking their life cycles through the introduction of a new crop, reducing the risk of total crop failure in cases of drought and disease outbreaks.

Soil Cover:

Reduces evaporation and so conserves moisture for the crop, suppresses weeds emergence, the organic residues improve organic matter content and soil nutrient status, provides a beneficial environment for soil organisms, moderates soil temperatures.



Principles of conservation agriculture

"Agriculture is the most healthful, most useful and most noble employment of man".

-George Washington