December
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

New Year Greetings from ICAR-NIASM…

The start of a new year is a very moving experience as it's the time to reflect on the achievements in the last year and set our hopes and targets for the days ahead. It brings new opportunities, challenges and perspectives to reinvigorate our enthusiasm towards achieving set goals and targets. Let the new year 2022 bring health, happiness and prosperity to all.

The current issue on Project Coordinator highlights the progress made under all the ICAR-NIASM projects during December, 2021 and targets for January, 2022. We made progress in research and development efforts particularly in 1) compiling soil chemical status data set for various states of India, 2) sowing of abiotic stress tolerant germplasms of different rabi crops, 3) recording of seedling trait observations in mutant lines of quinoa and chia, 4) recording of physical and chemical parameters of dragon fruit, 5) installation of rainpipe irrigation in CIFS, 6) recording of comparative haematological status in different breeds of goat for the month, 7) Conducting quantitative IAA production assay for bacterial isolates under high salt concentration (3.5% NaCl, w/v), 8) optimization of the protocol for study of endophytobiome (microbial community within root and stem), 9) analysis of socio-economic variables and constraints in farmers' adoption level, 10) measurement of growth, yield and post-harvest quality parameters of eggplant rootstocks at fruit stage using LSS, and 11) study of drought adaptive traits of soybean genotypes. Besides several extension activities such as visit of farmers, state government officials, students and print media persons to "Climate smart integrated farming system (CIFS) project, demonstartion of SORF to sugarcane farmers at Malad village were carried out.

ICAR-NIASM in collaboration with Indian Society of Plant Physiology (ISPP), New Delhi organized a National Conference of Plant Physiology with the theme "Frontiers of Plant Physiology for Climate-smart Agriculture" during December 9-11, 2021 at the institute in hybrid mode. Around 450 candidates including scientists, students, research scholars, private companies, progressive farmers from all over the country participated in this event. The Conference addressed the important issues pertaining to climate change and came out with new directions for researchers for tailoring productive plant types, developing plant bio-stimulants, climate resilient varieties with biotic and abiotic stress tolerance to help in breaking the yield barrier and thereby ensuring sustained food and nutrition security.

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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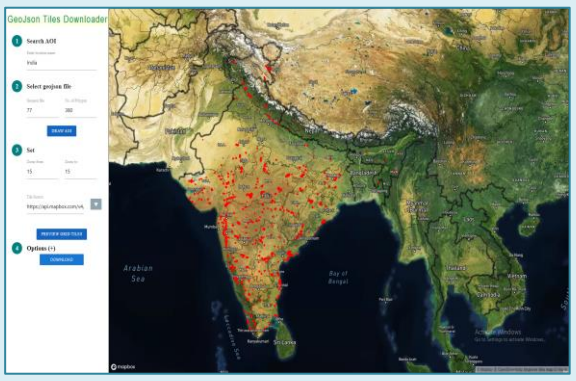
NCPP-2021 from 09-11 Dec, 2021 at ICAR, NIASM, Baramati

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, Gopalakrishnan B, Sunil V Potekar and Pravin H More



Geojson Tiles Downloader

Outputs

- Compilation of datasets on soil chemical properties for the state of Kerela, Chattisgarh and Odisha.
- Software "Geojson Tiles Downloader" for automated extraction of geo-server tiles using geojson vector files.
- Methodology for identification of fisheries cage culture in inland open water bodies using satellite imagery & generation of database of cage culture sites of India.

Targets for next month

- Preparing Climate analogues for livestock and crops (India basis).
- Continue with dataset collection across web-resource.

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

- Threshing & post-harvest observations of foxtail millet (118 accessions) and finger millet (77 accessions), & ground nut accessions (181 germplasm).
- Sowing of salinity tolerant wheat genotypes and quinoa germplasm for multiplication, maintenance & evaluation.
- Collection & conservation of different citrus rootstocks.

Targets for next month

- Agronomic crop management practices in wheat and quinoa germplasm.
- Recording of germination percentage and growth rate in different Citrus rootstocks.


Citrus rootstock 'Succatan'

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 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, Pravin B Taware, Rushikesh Gophane, Noshin Shaikh, Santosh Pawar and Avinash V Nirmale


Chickpea under aonla based agroforestry

Outputs

- Experiment in dragon fruit on canopy management, biomass assessment of shoot & root.
- Collection of native *Trichoderma* strains from medicinal & aromatic plant rhizosphere.
- Molecular characterization of anthracnose pathogen in dragon fruit.
- Experiment on deficit irrigation and growth regulators in pomegranate.
- Shade adaptive response of chickpea varieties under aonla based agroforestry systems.
- Application of biostimulants on grapes during pre-bloom, flowering, berry setting & version stage in different soil mixtures. The vine growth and NDVI was better in black soil.

Targets for next month

- Fruit quality analysis of guava; post-harvest quality in sapota; canopy management & root studies in dragon fruit; irrigation scheduling in pomegranate
- Growth, morphological and physiological observations in sapota & grapes.
- Evaluation of native *Trichoderma* sp. For management of dragon fruit pathogens.

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


Hoeing in chickpea

Outputs

- Sowing of groundnut & safflower & installation of rain pipe.
- Intercultural operation in chickpea & sorghum.
- Establishment of protein bank (Leucaena, Sesbania, Mulberry & Desmanthus).

Targets next month

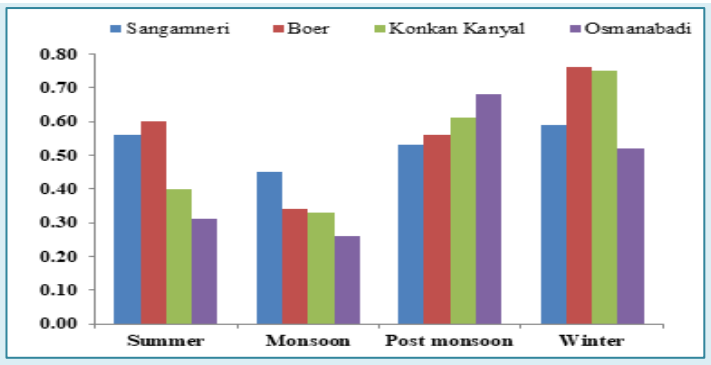
- Preparation of vermicompost, jivamrut & dashparni ark.
- Fertilizer management in horticulture crops.
- Preparation for disease pest management in crops.


Rain pipe irrigation

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, Gopalakrishnan B, Avinash V Nirmale and Sunil V Potekar



Growth rate (kg/week) of goat breeds during different seasons

Outputs

- Recording of comparative status of growth, feed & water intake, physiological and haematological parameters in four breeds of goat for December.
- Analysis of comparative growth performance (kg/week) of different breeds of goats for last four years; mass culturing of BSF.
- Assessment of thermal stress in poultry and goat for December.
- Faecal samples of goats from Undvadi (Supe) village revealed presence of infection of *Trichostrongylus* and *Trichuris* sp. ova.
- Evaluation of growth & biophysical analysis of GIFT tilapia to salinity stress.
- Adaptation & rearing of cold water fish Mahaseer in fisheries wet laboratory.

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; DNA isolation from four goat breeds for further polymorphism analysis; amplification of HSP genes from poultry.
- Biophysical analysis of salinity stress in GIFT tilapia; improvement of breeding unit of BSF & its mass culturing.

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

- Third and fourth date of sowing in quinoa in native murram and black soil.
- Thinning, weeding, and gap filling in 30 days old seedlings of quinoa.
- Recording of observation on seedling traits in quinoa and chia M2 lines.
- Frequency of chlorophyll mutations increased with increasing dosage.

Targets for next month

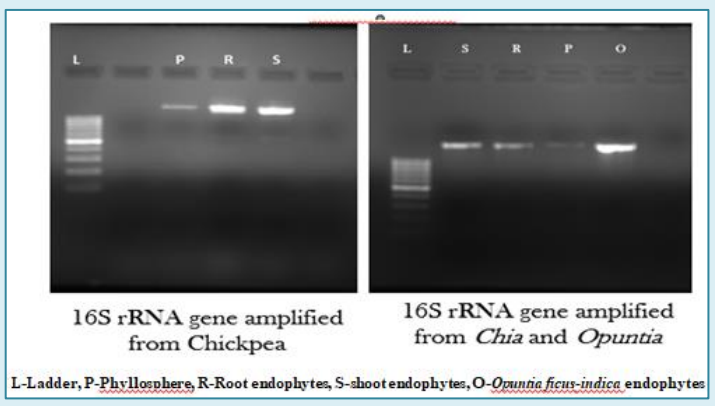
- Recording of observations (morphological & physiological) in quinoa.
- Observation at vegetative stage in M_2 mutant lines in Quinoa and chia.

Mutations in first pair of leaves: Different spectrum of chlorosis

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, Amresh Chaudhary and Himanshu Pathak



Amplification of 16S r RNA gene in chickpea, chia & opuntia

Outputs

- The protocol for study of endophytobiome (microbial community within root and stem) have been optimized and 16S rRNA gene have been successfully amplified for study of uncultured endophytic microbial communities of halophytes.
- The method has been validated in multiple plants species like chickpea, chia & cactus (*Opuntia ficus- indica*) using PCR approach.
- 16S rRNA gene has also been amplified for metagenomic DNA derived from leaf surface microbial communities.

Targets for next month

- 16S rRNA amplicon sequencing of the endophytic microbial communites halophytic plant species; rbcL gene sequencing for halophyte identification.

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

- The socio-economic variables such as education level, land holding, annual income and extension contacts were positively correlated whereas the age and farming experience variables has shown negative correlation with adoption level.
- Market price fluctuations (84%), high input cost (74%), less labour availability (66%), soil salinity (58%) and poor irrigation water quality were the major constraints reported by farmers in Pune district of Maharashtra.
- Publication of two fortnightly agro advisories on institute website for stakeholders.
- Coordination of visit of various groups of farmers, students and FPO's (234 visitors) to the ATIC/museum, research fields, IFS model and other technologies.

Targets for next month

- Preparation of questionnaire on bio-physical constraints & targeting perspective technologies for rabi crops.
- Supply of critical inputs to farmers TSP and SCSP.
- Survey and data collection of pomegranate farmers in relation to bio-physical and socio-economic constraints.
- Coordination of extension activities and visits of farmers/students to NIASM.

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, Satish Kumar, Aliza Pradhan, K M Boraiah, Pratap Singh Khapte and Jagadish Rane

Outputs

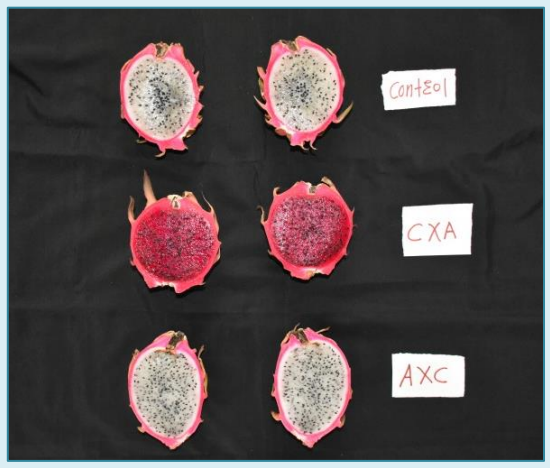
- Measurement of plant height, soil moisture, PS-II, CATD and hyper spectral reflectance observations at flowering stage of eggplant root stocks under water stress using LSS.
- Establishment of field trial for evaluating impact of plant growth regulators and deficit irrigation on okra (Cv. Panch Ganga).
- Measurement of PS-II and plant growth of sapota under different soils.
- Collection of fruit yields data of citrus.
- Analysis of the two years (2019 and 2020) growth and bulb yield data for assessing the onion responses to water logging stress.
- Experiments on pollinations in dragon fruit revealed that supplementary self-pollination increase fruit size up to 350 gm (55%) and matures/ripen 2-3 days early. Whereas cross pollination increases fruit size up to 500 gm (120%) and matures/ripen one week early compared to naturally pollinated fruits (225 gm).

Targets for next month

- Measurement of growth, yield and post-harvest quality parameters of eggplant rootstocks at fruit stage using LSS.
- Assessing the okra responses to plant bio-regulators in water stress using LSS.
- Measurement of fruit quality parameters of sapota orchard under different soil treatments.

Eggplant rootstocks under water stress using LSS

Comparison of selfed & cross pollinated dragon fruits



Cross section of naturally self-pollinated and hand cross pollinated dragon fruits

Visits to the Climate smart integrated farming system (CIFS)

In December, approximately 250 farmers, state government officials, students and print media persons visited “Climate smart integrated farming system (CIFS) farm project (ICAR-NIASM, Baramati). Projects staff of CIFS briefed about CIFS, its objectives and need. The CIFS project is extended on one hectare of land at the research field of the institute with diversified agricultural components including seasonal and perennial crops, livestock, fishery, water harvesting structures, and use of renewable energy source, organic manures etc. The information on every aspect of IFS systems such as cropping systems, horticulture, boundary plantation, silvipasture, multilayer and efficient irrigations techniques were provided. Further, farmers also sensitized on requirement of green and dry fodder to livestock and goats from the CIFS systems. “This model of climate smart integrated farming systems is eye-opener to fulfill the demands of our livestock, goats, and poultry with low inputs to sustain a family”, said by a visiting farmer. The agricultural officers appreciated the efforts of the ICAR-NIASM Baramati for demonstrating various climate resilient technologies. The visit was assisted by Dr. S.A. Kochewad, Dr. Sangram Chavan, Dr. Vijaysinha Kakade, Mr. Nilesh Dhumal and Mr. Akash Shinde of CIFS projects.

Farmers from Chandrapur

RTO official of Pune & Baramati

Sh. Amit Gadre, Editor of Agrowon, Sakal Pune

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 Wakchaure

Sr No.	Microbial culture	Accession No.
1	*Bacillus* sp. (in: Bacteria) NIASM9_2	LC467381.1
2	*Bacillus* sp. (in: Bacteria) NIASM32_6	LC467382.1
3	*Bacillus* sp. (in: Bacteria) NIASMJPSN	LC467356.1
4	*Bacillus* sp. (in: Bacteria) NIASMJP9R	LC467360.1
5	*Bacillus* sp. (in: Bacteria) NIASMJP16R	LC467358.1
6	*Kocuria* sp. NIMMe5	LC140962.1
7	*Nocardioides* sp. NIMMe6	LC140963.1
8	*Bacillus* sp. (in: Bacteria) NIASMS	LC467355.1
9	*Bacillus* sp. (in: Bacteria) NIASMY2	LC467359.1
10	*Rhizobium* sp. NIASMY7	LC467380.1
11	*Klebsiella* sp. NIASMY10N2	LC467354.1
12	*Pseudomonas* sp. NIASMX	LC027455.1
13	*Rhizobium* sp. NIASMXIII	LC027458.1
14	*Klebsiella* sp. NIASMY17	LC467361.1
15	*Rhizobium* sp. NIAMIXX	LC128410.1
16	*Bacillus* sp. (in: Bacteria) NIASMY80	LC467362.1

Sixteen pure cultures sent to NBAIM, Mau as general deposit submissions

Outputs

- Global Metabolome data analysis is in progress (mzXML file conversion, peak peaking and XCMS online submissions done).
- Important cultures submitted to ICAR-NBAIM Mau as General deposit cultures.

Targets for next month

- To continue with analysis of the global metabolome data and mapping the identified metabolites on biological pathways.

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

- Establishment of field trial to study the interactive effect of deficit irrigation (I1: 50% DI; I2: 75%DI and I3: 100% (full irrigation) and plant growth regulators (1800 ppm thiourea, 5 ml/L irradiated chitosan, 4 ml/L nano-urea, 25 µM salicylic acid and no PGRs).
- Performance of field trials of MRD/SORF machine for 50 sugarcane farmers at Malad village.
- Measurement of real time plant growth, water and soil parameters in existing field trials under the CA on sugarcane.
- Participation in international training "11th Advanced Course (Asia & North Africa) on Conservation Agriculture: Gateway for Sustainable Intensification of Smallholders Systems" organized by CIMMYT, CSSRI, and BISA, with support from ICAR and CGIAR research Programs on Wheat, Maize and CCAFS at Karnal/Ludhiana, India (06-18 December 2021)

Targets for next month

- Measurement of real time soil-water-plant parameters for sugarcane trials under CA.
- Compilation and submission of experimental results to consortia leader, IISS, Bhopal.
- Efficacy of bio-regulators in CA practices for managing water stress in sugarcane.
- Field trials/demonstration of MRD/SORF at farmers' fields.

Demonstration of MRD/SORF machine

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

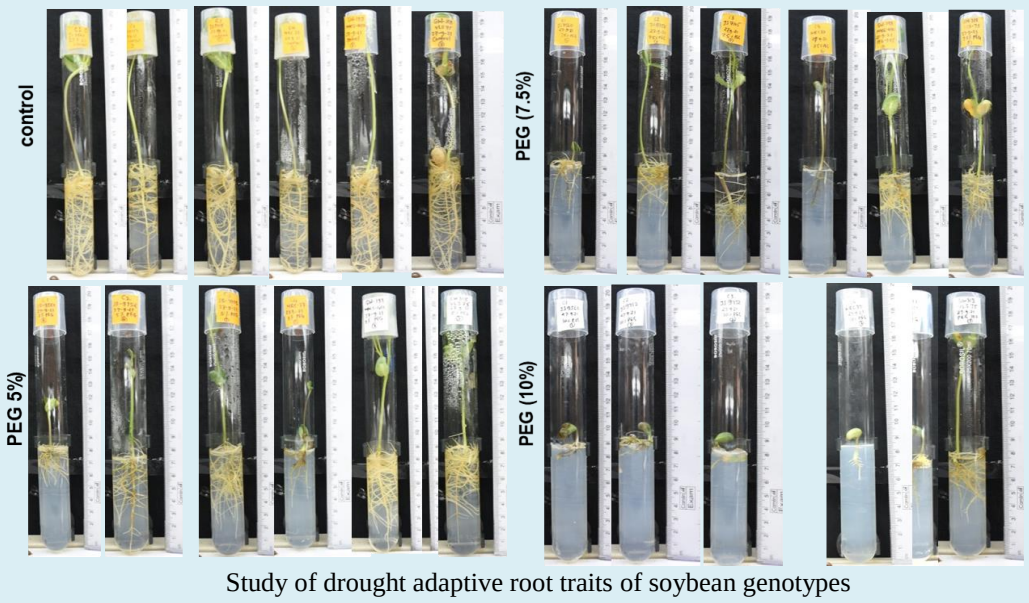
PI: Ajay Kumar Singh; **Co-PI(s):** Mahesh Kumar, and Jagadish Rane

Outputs

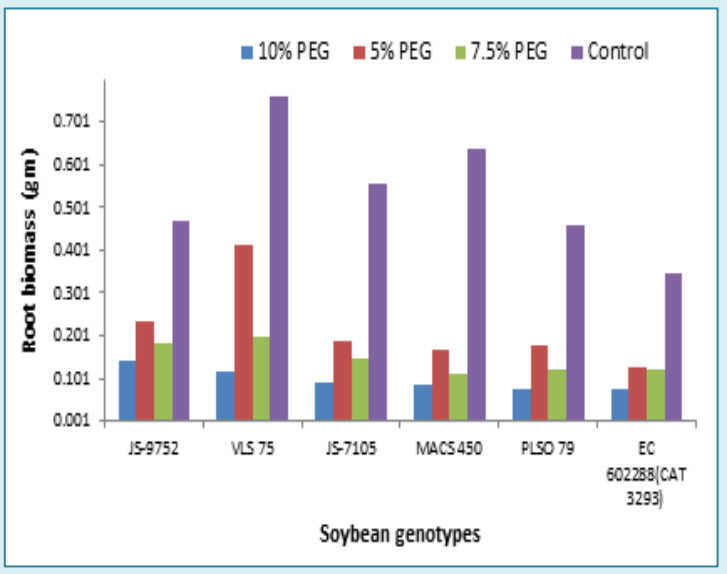
- Soybean genotypes evaluated for drought adaptive root traits. Soybean genotype VLS-75 showed better root biomass under PEG as compared to JS-7015 (Drought tolerant).

Targets for next month

- Expression profiling of 5 drought responsive genes in 18 promising soybean genotypes under no stress and drought stress conditions.



Study of drought adaptive root traits of soybean genotypes



Root biomass of soybean genotypes

Farmers' friendly techniques for enhanced seed germination in Indian Sandalwood

Sangram B Chavan, Dinesh K Yadav, Sneha Patil & Aniket More

Indian sandalwood (*Santalum album* L.) is indigenous to India and belongs to the family Santalaceae. It has a high demand for its highly valued essential oil and heartwood. The oil extracted from the heartwood is used as a fragrance enhancer and preparation of costly perfumes. It is strongly associated with tradition, religion and culture of Indian people. Since 2002, many legal issues are addressed by the state governments to promote sandalwood cultivation in farmer's field. But many business minded private nursery owners are selling sandalwood seedlings at higher cost which hinders farmers in getting quality planting stock. Low germination (20 %) in sandalwood further adds to the misery. The seeds of sandalwood have inherent morpho-physiological dormancy which leads to low and prolonged germination and poor establishment of seedlings. The seeds of sandalwood are impermeable to water and oxygen thus inhibits the germination of the seed. Various other factors also cause seed dormancy like impermeable seed coats, mechanically resistant seed coats, rudimentary and physiological immature embryo, morphologically mature and physiological immature embryos. Hence, there is a need to enhance the seed germination by breaking the seed dormancy through various pre-sowing seed treatments. To overcome this problem, a small experiment was carried out to standardize the seed germination in sandalwood at ICAR, NIASM.

Seeds of sandalwood were collected from Kerala Forest research Institute, Kerala. The seeds were pretreated with GA3 @ 500ppm and soaked for 12-16 hours. In one gram of GA3, few drops of ethanol was added to dilute followed by addition of two liters of water. Before sowing, seeds were also treated with fungicides (Bavistin @ 3 gram per 100 gram of seeds). The soaked seeds were sown on raised bed nursery at ICAR-NIASM. A compete flow chart of nursery preparation is presented below.

Nursery technique for seed germination:

- Raised bed of 3m x1 m size was prepared by using red soil, black soil & FYM at 3:2:1 proportion.
- Treated seeds (400 g on 3 sq m) were spread on raised bed and a layer of 2 cm potting mixture were used to cover the seeds. Raised beds were covered with polythene tunnel to maintain humidity and temperature.
- Watering was done twice a day to quicken the germination.
- Germination initiated within 22 days and continued for 45 days. A total 74 % of germination was observed. The seedlings of 3-4 leaf stage were shifted to polybag (5x7 inch). Before shifting, bed was irrigated to soften the soils and drenched with fungicides (Bavistin @ 1g per liter of water).
- Utmost care was taken in transplanting and the seedlings were kept in shade for 5-6 days to avoid transplanting shock.

Techniques for enhanced sandalwood seed germination at ICAR, NIASM

"For last year's words belong to last year's language, And next year's words await another voice. What we call the beginning is often the end, And to make an end is to make a beginning."

-T. S. Eliot