Vol. 03 No. 01 ISSN 2582-0915

अजैविक स्ट्रैस प्रबंधन समाचार

Abiotic Stress Management News

January to June 2022

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

ISSN 2582-0915

अजैविक स्ट्रैस प्रबंधन समाचार
Abiotic Stress Management News

भाकृअनुप- राष्ट्रीय अजैविक स्ट्रैस प्रबंधन संस्थान
ICAR-National Institute of Abiotic Stress Management
बारामती 413 115, पुणे, महाराष्ट्र, भारत
Baramati 413 115, Pune, Maharashtra, India

Vol. 03 No. 01 | An ISO 9001:2015 Certified Institute | January to June 2022

In this issue

RESEARCH HIGHLIGHTS

- Addressing sunburn, canopy management in dragon fruit
- Evaluation of soybean genotypes for root and drought adaptive traits.
- Identification and characterization of bacterial isolates for genetic diversity and salinity tolerance.
- Eggplant rootstock identification for drought tolerance.
- Pigeon pea genotypes response to transient waterlogging.
- Evaluation and identification of extra early maturing germplasm sources for common bean improvement
- Identification of sources for photo-thermo-insensitivity in chickpea genotypes.
- Kharif chickpea: new introduction to vegetable pulses in western Maharashtra.
- Alternative crops for water scarce regions.
- Long term impact of planting techniques and filling mixture in Guava and Sapota.
- Evaluation of halotolerant Rhizobium and PGPB-based biomolecules for alleviation of drought and salt stress.
- Abiotic stress Information system (Beta version).
- Investigations on suitable day hours available for RPAS applications in Indian agriculture.
- Targeting prospective technologies for abiotic stress resilience in rainfed and dryland regions.
- Seasonal haemoglobin level variations in goats.
- Detection, etiology and phylogenetic analysis of stem canker and anthracnose pathogen in dragon fruit.
- Genotypes with high stem reserve mobilization can overcome the impact of rust on chickpea yield.
- Identification of fruit size and quality enhancing dragon fruit clones and its adoption
- Genetic garden accessions and variations in Chia mutants
- Nursery raising protocol for chia for rapid multiplication
- Intercropping of soybean with sugarcane in spring season.
- Biomass equation and carbon storage in Melia dubia.
- Performance of various Fodder-based systems in CIFS.
- Performance of lemongrass in Sandalwood-Tamarind agroforestry systems.

NEW INITIATIVES

MAJOR EVENTS

LIST OF ONGOING PROJECTS

TRAININGS ATTENDED

PUBLICATIONS

PERSONALIA

From the Director's Desk.....

Greetings from ICAR-NIASM

India will be celebrating 75th year of Independence this year with glorious achievements in all the sectors, majorly the self-sufficiency in agriculture, livestock and fisheries. Though India has transitioned significantly in several areas of agriculture production and productivity through extensive research and extension efforts, it continues to face the challenges posed by extreme weather events and abiotic stresses. The ever-ready approach needed to tackle the negative impacts of abiotic stresses in agriculture calls for the continued efforts on basic, strategic and applied research solutions alongwith critical planning and action at all levels. This should lead to a better understanding of the underlying processes and practical solutions.

In pursuit of this endeavour, ICAR-NIASM has been carrying out planned scientific explorations and their subsequent dissemination to the stakeholders through outreach activities. The recent research finding of the work carried at the institute are presented in this newsletter. This includes findings from the experiments done for management of prominent abiotic stresses in crops like dragon fruit, soybean, eggplant, chickpea, pigeon pea; livestock and poultry and fishes; along with explorative and strategic work in area of microbes for alleviation of salt and drought stress; detection of new pathogens in dragon fruit; performance assessment in agroforestry systems, beta version of ASIS, impact of weather parameters on drone utility in agriculture and prospective technologies for abiotic stress resilience in rainfed and dryland regions. Several new initiatives, including the installation and operationalization of automated irrigation and fertigation facility; automatic weather station and extension of experimental goat shed were undertaken and completed with great zeal. ICAR-NIASM celebrated world environment day, 73rd republic day, world pulse day, agricultural technology week, world soil day, 14th foundation day of the institute and several other national and international events of importance through physical and online mode. Institute also hosted several of the important meetings that gathered eminent personalities across domains. Outreach activities including swachatta campaigns, distribution of inputs to beneficiaries under DAPSC and TSP programmes; and farmer trainings were also carried out.

I thank the Editorial Board for their sincere efforts in bringing out the Newsletter. I place on record my thanks to all the staff members of ICAR-NIASM for their contributions in bringing out this issue of the Newsletter.

31 June, 2022

(Himanshu Pathak)

RESEARCH HIGHLIGHTS

Addressing sunburn and canopy management in dragon fruit (Hylocereus spp.)

VD Kakade, Scientist, Fruit Science

An experiment exploring ways to protect dragon fruit from sunburn was carried out using shade nets of different colours (Green, black and white) and shade factors (35 and 50%). Preliminary results showed that sunburn in dragon fruits could be avoided using artificial shading using shade nets (Fig. 1(a)). Further shading also reduced disease incidence by up to 50%, early flowering, and the emergence of new sprouts. In addition, plants maintained their photosynthetic efficiency compared to uncovered plants (Fig. 1).

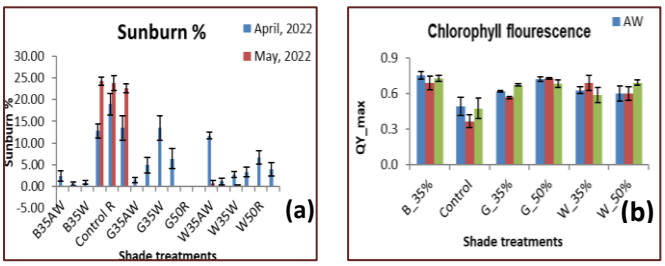


Figure 1. (a). Effect of different shade nets on sun burn management in dragon fruit. (b). Chlorophyll fluorescence (PS II) under different shade treatments.

In another experiment carried out for Canopy management in Dragon fruit (Hylocereus undatus) for maximizing productivity, plants with different cladode numbers were categorized, and observations on growth, flowering, fruiting and sunburn and disease incidence were recorded during the year 2021. It was observed that sunburn in dragon fruit was more in plants with a higher percentage of old cladodes than plants with sparse canopy (Fig. 2(a)). A similar trend was observed in the case of disease incidence (Fig. 2(b)).

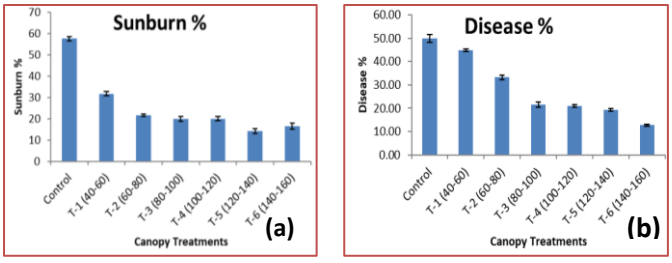


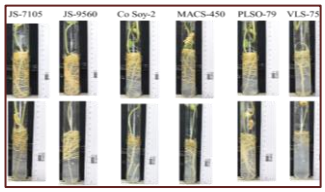
Figure 2. (a). Impact of canopy management on sun burning. And on (b). disease incidence.

The impact of shading and canopy management on flowering and fruiting is under observation.

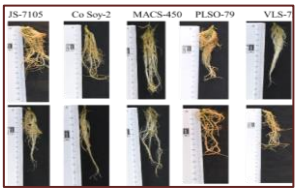
Evaluation of soybean genotypes for root and drought adaptive traits.

AK Singh, Principal Scientist, Agricultural Biotechnology

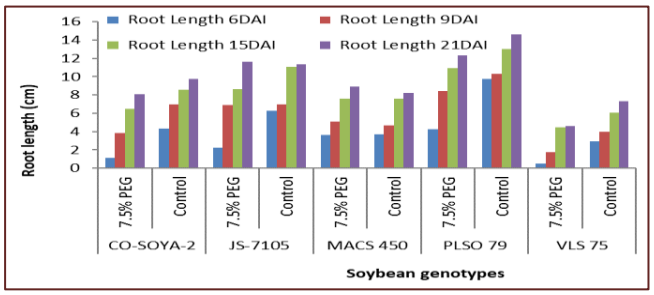
Promising soybean genotypes Co-Soy2, MACS-450, PLSO-79 and VLS-75 were evaluated for root traits under control (without PEG) and induced desiccation (supplemented with 7.5% PEG in ½-MS medium) employing in vitro techniques. Soybean genotypes PLSO-79 had higher biomass and longer root than check varieties JS-7105 and JS-9560.

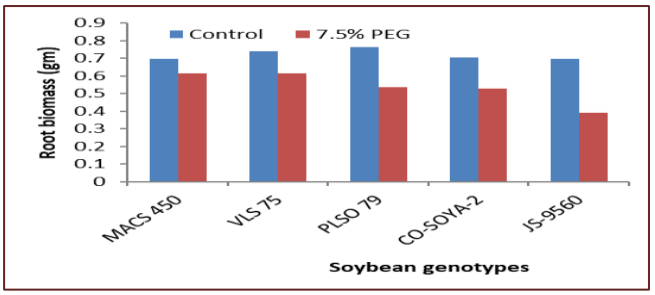


Control (No-PEG)

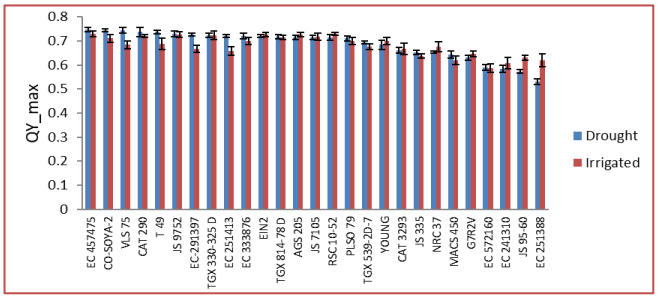


7.5 % (PEG)





Twenty-five soybean genotypes and check varieties JS-7105, JS-9752, JS-335, NRC-37 and JS-9560 were evaluated for photosystem-II efficiency.

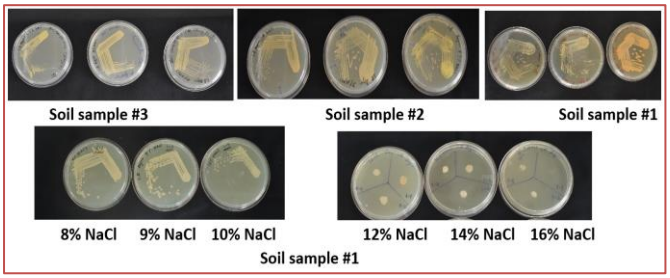


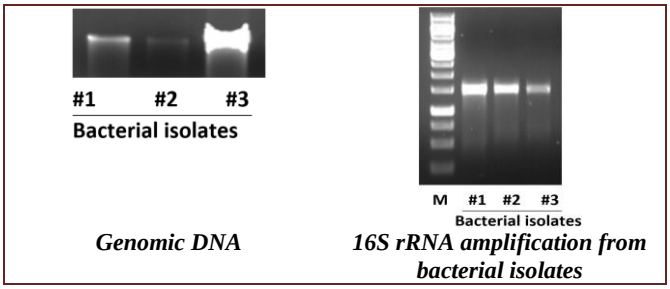
Soybean genotypes EC-457475 showed higher PS-II efficiency than check varieties under no stress and drought stress conditions.

Identification and characterization of bacterial isolates for genetic diversity and salinity tolerance.

AK Singh, Principal Scientist, Agricultural Biotechnology

Bacterial samples were isolated from rhizosphere of halophytes and characterized for colony characteristics. The 16S rRNA was PCR amplified for genetic diversity study of bacterial isolates.





Genomic DNA *16S rRNA amplification from bacterial isolates*

Identification of rootstock for enhancing drought tolerance in eggplant

PS Khapte, Scientist, Vegetable Science

Six promising wild species of eggplant were chosen from the thirteen wild species evaluated for morphological and physiological traits for performance under drought stress. Further, these selected wild species were used as a rootstock for commercially cultivated eggplant variety cv. Suraj. These graft combinations and non-grafted plants were evaluated under controlled greenhouse and field conditions. In the control greenhouse experiment, the graft combinations were subject to water deficit stress, withholding water for twenty days after thirty days of transplanting in the pots. The grafted plants in well-water treatment were maintained at 70 % field capacity. It was found that eggplant cv. Suraj grafted onto Solanum sisymbriifolium rootstock (SUR/SIS) was highly tolerant to drought stress based on the number of traits examined, particularly higher root to shoot ratio (0.30), PS-II efficiency (0.71), and maintained higher leaf RWC status (52.80%). Further, the same rootstocks were transplanted in a field trial under deficit irrigation treatments. The eggplant grafted onto S. sisymbriifolium exhibited a 20% increase in yield (4.41 kg per plant) under deficit irrigation (60% ETc) as compared to non-grafted plants (3.65 kg per plant).

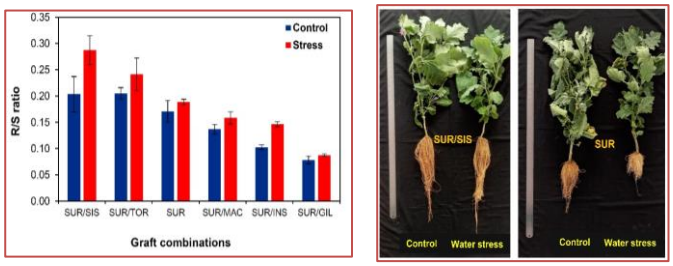


Figure 3: Higher root to shoot ratio of Suraj grafted onto Solanum sisymbriifolium rootstock

Therefore, S. sisymbriifolium seems to be a potential rootstock for the eggplant to alleviate the effect of water deficit stress and enhance yield.

Response of pigeon pea genotypes to transient waterlogging durations

Basavaraj PS, Scientist, Genetics and Breeding

The experiment was conducted with 50 diverse pigeon pea genotypes and four check genotypes under laboratory conditions. In the lab condition, ten seeds of each genotypes were kept in a Petri plate filled with water (complete submergence) for about 2, 4, 6, 8 with 3 replications each. After the respective days of stress treatment, seeds were taken out, excess water was drained out, and seeds were kept for gemination under normal conditions. The germination percentage and root and shoot length were measured and waterlogging tolerance coefficient were estimated. It is found that ICP-5863, ICP-6370, ICP-16309, ICP-6128 and ICP-7869 showed highest waterlogging tolerance coefficients than check genotypes ICP-5028, MAL-15 under different durations of waterlogging stress. Similarly, genotypes viz, GRG-811, ICP-6815, ICP-6845, ICP-7375, ICP-7507, ICP-7314, ICP-16309, ICP-5863, ICP-6128, ICP-6370, ICP-7223, ICP-10228, ICP-7803, ICP-8255 and ICP-7366 recorded 100 percent survival rate under all (control, 2, 4 ,6, 8 days) of submergence stress treatment. The seedling length was also varied among genotypes for different durations of submergence treatment. Among the genotypes, GRG-811, ICP-6815, ICP-6845, ICP-7507, ICP-7314, ICP-16309, ICP-5863, ICP-6128, ICP-6370, ICP-7223 and ICP-10228 recorded higher seedling length after stress treatment for eight days.

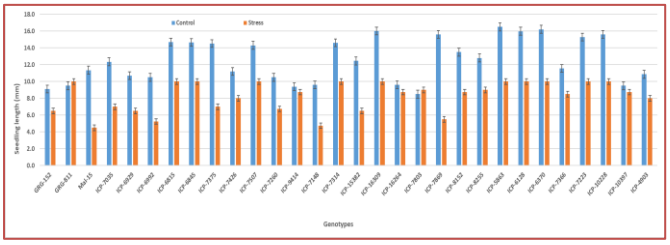


Figure 4 . Genetic variation for seedling length after 8 days of submergence among pigeon pea genotypes

Further, a pot experiment was conducted to know the performance of these genotypes for transient waterlogging stress treatment at the early seedling stage of the crop. Filled pots were sown with 5 seeds/pot at 17-20 mm depth following a completely randomized design. Before the imposition of stress treatment, the number of plants in each pot was counted. Transient waterlogging was achieved by immersing five pots (20 days old seedlings) in a cement tank filled with water for ten days, with the pot surface remaining at least 20mm under water for the duration of the experiment (10 days), while the sixth pot was kept at normal moisture as a control. Throughout the stress treatment, the water level in the pot was maintained at the same level for ten days. After 10 days of stress treatment, excess water in the pots were drained and allowed to recover. The number of plants that survived in each pot 10 days after the waterlogging stress treatment was counted, and the rate of survival was calculated based on the number of plants in each pot before treatment.

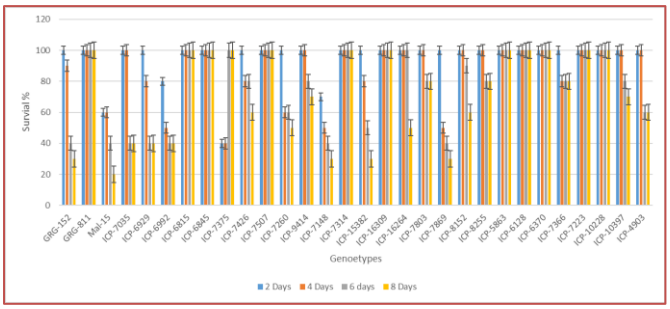


Figure 5. Genetic variation among pigeon pea genotypes for survival under 2, 4, 6, 8 days of submergence treatment.

The genotypes showed a broad range of variation for stress treatment among the 54 genotypes, including checks used in the present study; only 33 genotypes survived 10 days of transient waterlogging stress. Observations on days to 50% flowering, number of primary and secondary branches per plant, plant height and pods per plant, seeds per pod, 100 seed weight and grain yield per plant were recorded from both control plants and stress-imposed plants. There was significant variation among the genotypes for all the traits studied among the stress and control treatment.

Evaluation and identification of extra early maturing germplasm sources for common bean improvement

Gurumurthy S, Scientist, Plant Physiology

The development of early-maturity genotypes helps common bean to improve the speed of breeding and extra income within a short duration. The main objectives of this study were to assess the flowering, pod setting and relationship between grain yield and its attributing traits such as pods/plant, 100 seed weight and maturity duration under Kharif season (off-season). A total of five promising germplasm lines viz, IPR-52-19, IPR-205-19, IPR-277-19, IPR-236-20 and IPR-242 B-20 were evaluated in the western zone of the Indian environment (ICAR-NIASM, Pune) during Kharif 2021 (June-September). Both agronomic and yield-component traits were recorded. The results exhibited that a wide range of genetic variability was observed among germplasm lines, and trait correlation coefficients were estimated. From this study, we identified a climate-smart extra early maturing germplasm such as IPR-236-20, which matures within 78 days by giving a good yield.

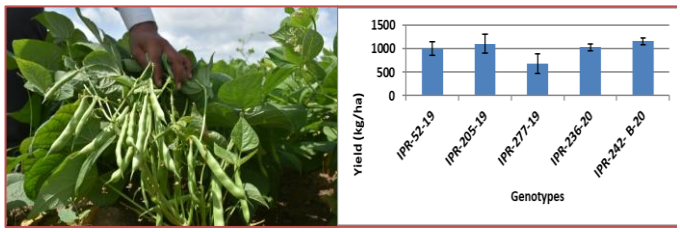


Figure 6. a) pod set b) Yield in common bean during Kharif 2021.

Identification of sources for photo-thermo-insensitivity in chickpea genotypes

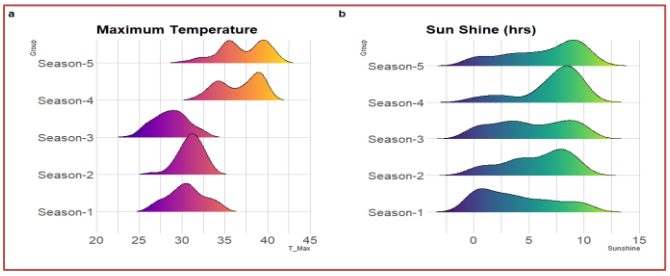
Gurumurthy S, Scientist, Plant Physiology

Growing the same cultivars of chickpeas across different seasons and locations is constrained by their light and heat sensitive behaviour. In ICAR-NIASM, Pune performed the preliminary experiment on photo-thermo-insensitivity in chickpea genotypes. During the 2021 kharif season, 74 chickpea genotypes were evaluated under natural field conditions. Based on the performance of the genotypes, the early maturing

genotypes identified were ICE 15654-A, IPC 06-11, JG-14, ICCV 92944, Vishal, Vijay, JG-11 and JG-16, and the photo-thermotolerant trait during the late Kharif 2021, Rabi 2021-22, summer 2022 and early Kharif 2022.

Sr. No.	Season	Sowing date	Harvesting date	No. of days
1	Kharif 2021	June 19, 2021	Aug 30, 2021	72
2	Late Kharif 2021	Aug 30, 2021	Nov 22, 2021	83
3	Rabi 2021-22	Nov 17, 2021	Feb 12, 2022	87
4	Summer 2022	Feb 19, 2022	April 26, 2022	66
5	Early Kharif 2022	April 26, 2022	June 17, 2022	54

The maximum temperature and sunshine duration were more than 35 degrees Celsius and 8 hours in summer 2022 and late Kharif 2022, but these genotypes still flowered and set the pods. The late Kharif 2021 was not greatly affected. The adverse effects of the summer of 2022 and early Kharif 2022 have been studied. Among them are good results in terms of yield. Therefore, it can be concluded that the chickpea genotypes ICE 15654-A, IPC 06-11, ICCV 92944 and JG-14 can withstand 40 degrees Celsius under field conditions. The identified donors can be used to develop photo-thermo-insensitive genotypes in cultivated chickpea species



Kharif Chickpea: A new introduction to vegetable pulses in Western Maharashtra

Gurumurthy S, Scientist, Plant Physiology

Chickpea (Cicer arietinum L.) crop is widely cultivated in the arid region of India during the rabi season (October-February) and is primarily consumed as "daal" as a protein source. However, it has very good potential for off-season cultivation (June-August) in some parts of India especially Western Maharashtra for vegetable purposes. After preliminary investigations, we identify promising chickpeas genotypes which are bold green, have shiny seeds and extra-early maturity in 69-70- and 76-80-days under rainfed and irrigated conditions, respectively. The yield of matured green chickpea plants with pods was between 70-88 and 115 - 176 q ha^{-1} under rainfed and irrigated conditions; however, raw green chickpeas pods yielded between 30-45 and 19-24 q ha^{-1} under irrigated and rainfed conditions. We identified two genotypes GG-2 and GNG 2171 that showed the highest green plant yield with 176 and 87 q ha^{-1} yield under irrigated and rainfed conditions, respectively. Also, the highest raw green chickpea pod in JG-14 and GNG 2171 with 45 and 24 q ha^{-1} under irrigated and rainfed conditions, respectively, were recorded. Thus, the introduction of chickpea as a "Kharif crop" in the new niche will exponentially enhance the farmer's income as well as secure the nutritional requirement

Figure 7. Products of Kharif chickpea; a- green chickpeas plant, b- raw green chickpeas pods, c- raw tender green chickpea of 60 days old

Alternative Crops for Augmenting Farm Income in Water Scarce Regions

Aliza Pradhan, Scientist, Agronomy

Alternative crops are adapted to a range of agro-ecologies, are nutrient dense, climate resilient, and offer better prospects in abiotic stress areas with low-input agriculture. However, turning the potential of these crops into real benefits requires a systematic approach, multidisciplinary analysis, multi-stakeholder consultation and cross-sectoral coordination. Optimizing agronomy of these crops in a new agro-ecological region needs strategies related to sowing time and technique, cropping season, water management, fertilizer management, harvesting, and post-harvest management. Against this backdrop, a field experiment was conducted to

evaluate the effect of different sowing dates, irrigation techniques and nitrogen doses on quinoa productivity and quality in native murram soil in Rabi 2021-22. The treatments comprised of three factors: a) Date of sowing (4 levels): 1st November (D1); 15th November (D2), 1st December (D3), 15th December (D4); b) Irrigation (2 levels): Irrigation at 80% crop evapotranspiration (ETc) (I1); Irrigation at 40% ETc (I2); c)nitrogen doses (3 levels): 100 kg N ha^{-1} (N1); 150 kg N ha^{-1} (N2); 200 kg N ha^{-1} (N3). The experiment was laid out in a strip-strip plot design with the date of sowing in vertical and irrigation as horizontal strips in main plots followed by nitrogen dose as vertical strips in sub plots with three replications. Data related to crop morphological (plant height, leaf area, shoot and root weight, shoot: root, days to flowering), physiological (photosynthetic rate) and yield attributes (no. of panicle per plant, panicle height, seed weight per plant, seed yield) were recorded and analyzed.

Figure 8. Appearance of drought-challenged spinach seedlings under the influence of bioformulation-treatment

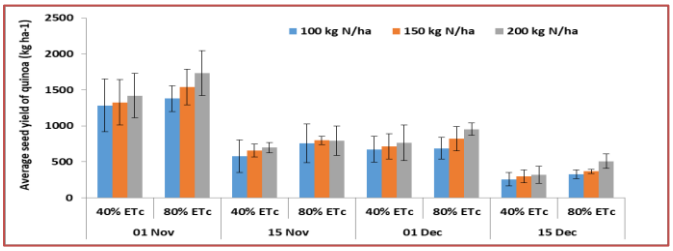


Figure 9. Effect of treatments on seed yield of quinoa in native murram soil

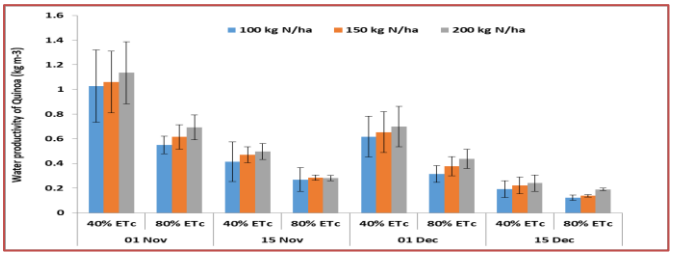


Figure 10. Effect of treatments on water productivity of quinoa in native murram soil

It was observed that the highest seed yield of 1700 kg ha^{-1} was found in plots sown on 1st November with 80% ETc and 200 kg N ha^{-1}. Similarly, maximum water productivity of 1.13 kg m^{-3} was observed on 1st November with 40% ETc and 200 kg N ha^{-1}. Therefore it can be inferred that delay in sowing quinoa after 1st November has reduced the advantage of water and nitrogen input.

Long-term impact of planting techniques and filling mixture in Guava and Sapota

VD Kakade, Scientist, Fruit Science

To evaluate the performance of different planting techniques and filling mixtures in perennial fruit crops like guava and Sapota; growth and yield parameters are being measured. Planting systems with enhanced are performing better compared to pits of 45 cm^3 in Sapota (Fig. 11) and Guava. Parameters like total chlorophyll, relative water content, membrane stability index, NDVI, etc. are also being recorded along with plant yield. Confirmation of results is to be obtained in the coming couple of years' data.

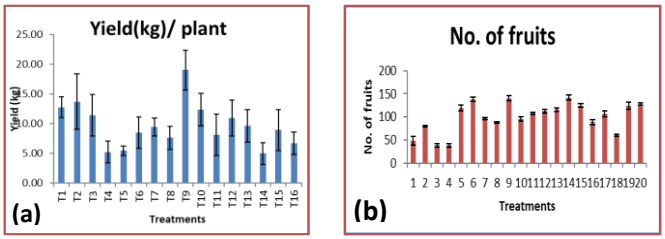


Figure 11. (a). Effect of planting systems and filling mixture on yield of Sapota. (b). Effect of planting systems and filling mixtures on yield of Guava.

Evaluation of halotolerant Rhizobium and PGPB-based biomolecules for alleviation of drought and salt stress

Kathikeyan N, Scientist, Agricultural Microbiology

To extend the scope of bacterial biomolecules-application in a range of agricultural crops, a product was formulated by amending a variety of synthetic and semi-synthetic components, including plant growth hormones, carbohydrates, and amino acids and peptides. This product was evaluated in spinach for growth enhancement under greenhouse conditions. The product successfully ranked higher in performance against the control and individual components of the formulation. Further evaluations relating to the performance of the product and quality improvement are in progress and have been

planned to evaluate under field conditions during the upcoming seasons.

This experiment mainly investigated the performance of microbial biomolecules based bioformulation towards mounting drought stress tolerance in spinach (Spinacia oleracea L.). The spinach seeds were sown in poly-bags placed in greenhouse facility at the ICAR-NIASM campus (Fig. 12). The seedlings were allowed to grow for 15 days under normal moisture conditions, after which the drought stress was imposed by restricting the irrigation (2:1 irrigations-normal: stress), with the bioformulation was applied through the foliar spray at weekly intervals for four weeks. Then the plants were harvested and subjected to measurement of physicochemical attributes.

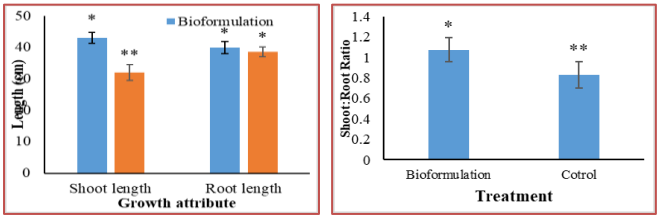


Figure 12. a) Appearance and b) Shoot:root ratio & canopy temperature of drought-challenged spinach under the influence of bioformulation-treatment

The results indicated a significant influence of bioformulation application on spinach's overall growth and development under water deficit conditions. An increase in shoot length over the control under the influence of bioformulation treatment signified the relatively sound phenotypic status of the plants. The root length, though exhibited a higher count than that of the control, it remained statistically insignificant. Comparatively longer root length in control lowered the shoot: root ratio, which could be attributed to the natural strategy of plants to search for water under limiting moisture conditions (Fig. 12). In the case of treatment both the root and shoot exhibited parallel development, indicating higher efficiency of the seedlings towards coping up with the induced drought conditions.

Canopy temperature is an important indicator of plant responses to drought stress. Not surprisingly, the canopy temperature of the bioformulation-treated spinach seedlings in this experiment also exhibited significant variation over the control. As anticipated, the canopy temperature of untreated (control) seedlings remained higher when exposed to drought conditions. However, the bioformulation treatment successfully reduced the seedlings' rising canopy temperature even under drought conditions (Fig. 12). This indicated a positive influence of the bioformulation application at the physiological level in spinach under drought conditions. Similarly, other physicochemical biomarkers also exhibited significant positive variations in bioformulation-treated seedlings indicating the successful mitigation of drought stress. The performance of the formulation was also evaluated against individual components under normal conditions to determine an interactive effect of the individual component moieties. Growth characteristics of the crop appeared better over the individual components of the formulation, signifying a positive development interaction during the integrated performance of different components in the form of a formulation.

Abiotic Stress Information System (β-version)

BB Gaikwad, Senior Scientist, Farm Machinery and Power

The beta version of the Abiotic Stress Information system (ASIS) has been developed and is hosted on www. niam.res.in/asis#. It consists of modules on Atmospheric and Soil Stress information for generating query-based geospatial maps. The Atmospheric stress information module sources data using API services offered by IMD for daily weather warnings, forecast and nowcast. Several utilities based on dynamic weather data are being added to assist stakeholders in decision-making. The Soil stress information system uses farmer-level datasets of the Soil health card scheme of the Government of India curated based on threshold criterias for nutrient specific values, geo-fencing and de-duplication approaches.

Figure 13. Screenshot of the ASIS webpage

Few of the sub-modules listed under each menu headings have been made operational and others are under active development. All the datasets used in the development of ASIS are open-source and available in the public domain. The framework of the beta version of ASIS has been developed using open-source and free tools utilizing javascript, html, python languages and GIS tools viz. QGIS, ArcGIS, and Mapbox services.

Investigations on suitable day hours available for RPAS applications in Indian agriculture as impacted by local weather parameters

BB Gaikwad, Scientist, Farm Machinery and Power

The remotely piloted aircraft systems (RPAS) (also known as UAV/ drone) based agricultural applications, primarily for crop protection, is being promoted in India by the government. Considering the speedy surveying and spraying operations possible as compared to the conventional methods, the RPAS usage is also thought to be prospective tool in management of abiotic, biotic stresses occuring in agriculture. However, its economic and practical feasibility is yet to be established for Indian agriculture. The annual use hours of a farm machine/equipment is an important metric needed to calculate the economic feasibility and directly affects the purchase decisions by stakeholders. The annual use hours are dependent on several factors but primarliy on weather parameters during and after RPAS operation accomplishing a specific use case, such as spraying chemicals, crop assesment etc. A study was undertaken to investigae the spatio-temporal hours suiting RPAS applications in India. Hourly gridded meterological data of recent twelve years (2010-2021) covering entire India was processed to derive mean spatio-temporal (annual, monthly and seasonal) day hours suiting three usage senarios viz., chemical pesticide spraying (U1); crop assessment using passive optical sensors (U2); and research studies requiring use of additional multispectral/hyperspectral onboard sensors (U3). The threshold values for each of weather parameter (wind speed, rainfall, total solar radiation, maximum temperature, minimum temperature and minimum all-sky isolation index (KT) values) were defined based on the review of literature. These thresholds aimed at minimizing spray drift, avoid repeat applications due to immideate rains within 6 hours of spray application. Similarly, the threshold for crop assessment and research purposes was defined to minimize errors arising in captured data due to low solar irradiation, cloud cover, and destabilizing wind velocities. The gridded hours satisfying the threshold criteria were interpolated using TIN interpolation technique to 3 km × 3 km spatial resolution to further calculate the zonal statistics, teshil-wise and across several geographical aggregation levels viz., agro-climatic zones, agro-ecological zones, sub-agro ecological zones and meteorological zones of India.

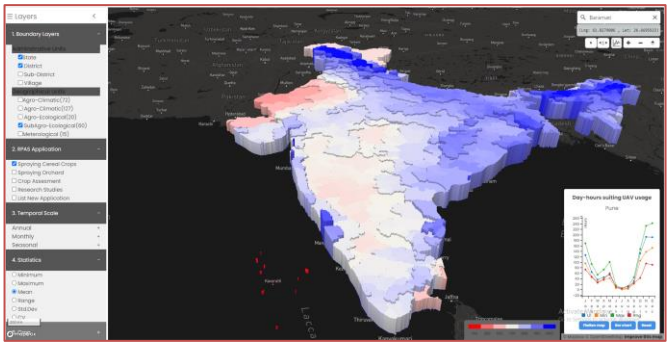


Figure 14. Screenshot of the RPAS webpage showing annual day hours suitable for spraying cereal crops.

It was observed that annual day hours suitable for drone application ranged from 610.5 to 1355 for the agro-climatic regions. However, the monthly day hours suiting drone usage had larger deviations across year at majority of geographical aggregations with monthly use hours as low as 20 hours during monsoon months owing to higher wind speeds and rainfall. This is in contrast to the anticpated maximum utility desired during kharif crop growing season that majorily contributes to Indias annual agriculture production. Therefore, additional UAV usages need to be explored for additional operational hours during lean months not suiting investigated UAV applications in agriculture.

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

K Ravi Kumar, Scientist, Agricultural Extension

To assess the effect of abnormal temperature and unseasonal rains on pomegranate, farmers perceived the incidence of fruit cracking (42.5%) and sun burn damage (45%) as major effect on pomegranate orchards due to rise in temperature. Whereas farmers also reported the incidence of early unwanted sprouting (52.5%) and fruit drop (32.5%) as ill effects of unseasonal rainfall. 37% farmers responded that incidence of flower drop due to waterlogging in pomegranate.

Identification of farm ponds and storage water tanks using satellite imagery for targeting farm pond-based aquaculture in rainfed areas of Maharashtra. Prioritization of strategies and policy reforms to support fisheries sector during and post-Covid-lockdowns, using the Multi-Attribute Decision Making (MADM) techniques.

Comparative studies on effect of seasonal variation on haemoglobin levels in goats.

NP Kurade, Principal Scientist, Veterinary Pathology; SS Pawar, Senior Scientist, Animal Biotechnology; AV Nirmale, CTO

Besides assessing comparative thermal stress in different breeds of goats, viz Osmanabadi, Sangamneri, Konkan kanyal and Boer, impact of climatic variation, on physiological and haemato-biochemical parameters, was also assessed. Seasonal variation of haemoglobin in different breeds of goat during 2021 to 2022 assessed. Boer goats revealed significantly lower hemoglobin values during monsoon an post monsoon periods. Haemoglobin values of other indigenous goat breeds didn't show significant variation during various seasons.

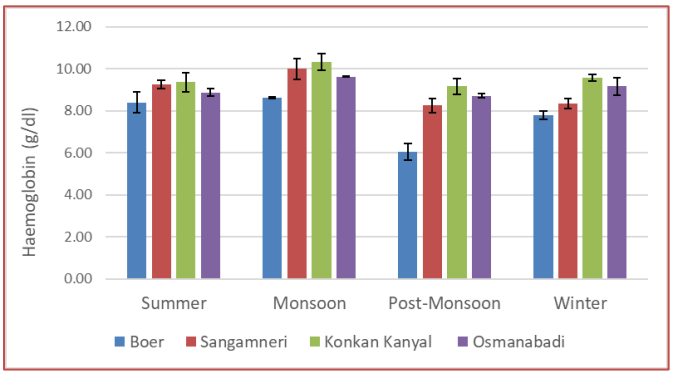


Figure 15. Seasonal variation of haemoglobin in different breeds of goat during 2021 to 2022

Detection, etiology and phylogenetic analysis of stem canker (Neoscytalidium dimidiatum) and anthracnose (Colletotrichum truncatum) pathogen in dragon fruit

Vanita Salunkhe, Scientist, Plant Pathology

The production constraints in dragon fruit arising due to abiotic stresses invite biotic stress events also. During survey, H. undatus and H. polyrhizus plantations from Pune, Satara and Solapur districts of Maharashtra were found affected with stem canker disease. Initial symptoms on infected cladodes were minute, circular, depressed chlorotic spots often with a brick red flecks followed by elevation of the centre of the lesion. Later the lesions turned necrotic and contained black, erumpent pycnidia, followed by chlorosis and stem rot. detailed diagnosis of stem canker pathogen was carried out at ICAR-NIASM, and based on morphological and phylogenetic analysis the pathogen was identified as Neoscytalidium dimidiatum. Pathogenicity test confirmed N. dimidiatum was the cause of stem canker in H. undatus and H. polyrhizus. This is the first report of N. dimidiatum causing dragon fruit stem canker in India. Since the disease poses a major threat to dragon fruit plantations, additional epidemiological studies may assist in developing management strategies.

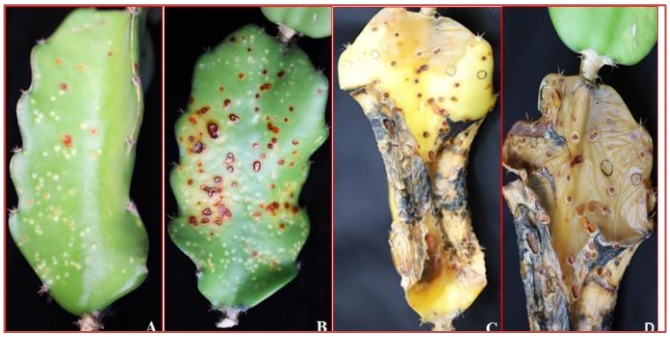


Figure 16. Field symptoms of stem canker (A. chlorotic depressed spots often with a red flecks; B. elevation of the lesion centre turning red to gray; C. yellowing, brown scab with pycnidia; D. complete rotting of cladode) of dragon fruit

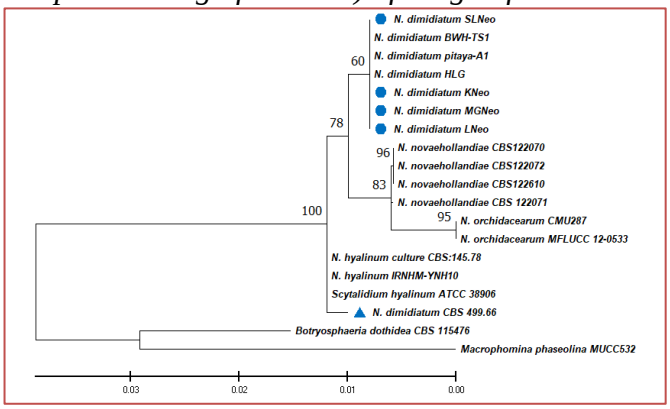


Figure 17. Phylogeny tree of Neoscytalidium. dimidiatum isolates

1-α genes of *Neoscytalidium. dimidiatum* isolates from diseased dragon fruit by using maximum likelihood analysis in MEGA11. Bootstrap values >50% (1,000 replication) are given at the nodes. *Botryosphaeria dothidea* and *Macrophomina phaseolina* used as the outgroups.

Anthracnose caused by various Colletotrichum species is also an emerging issue in dragon fruit cultivation and several Colletotrichum species associated with the disease has been already

reported from various countries. Recently, in India, C. siamense cause of dragon fruit anthracnose was reported from Andaman region. Anthracnose is found to be very common during rainy days. Detailed phyto-pathological investigation of cause of dragon fruit anthracnose was carried out at ICAR-NIASM. Based on, morphological and phylogenetic analysis the pathogen was identified as Colletotrichum truncatum. Detailed diagnosis study will help for formulating future management strategies.

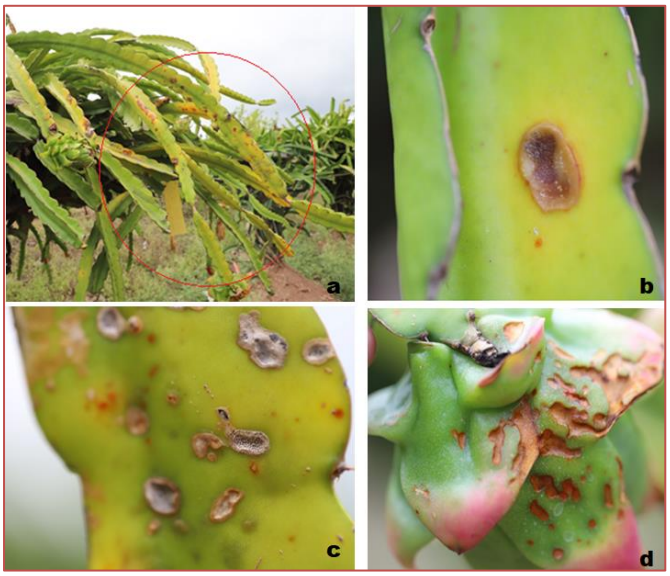


Figure 18. Typical symptoms of anthracnose (a. infected plant; b. water soaked sunken lesion with acervuli development; c. later stage necrotic lesions with black acervuli; d. sunken water-soaked lesions on fruits).

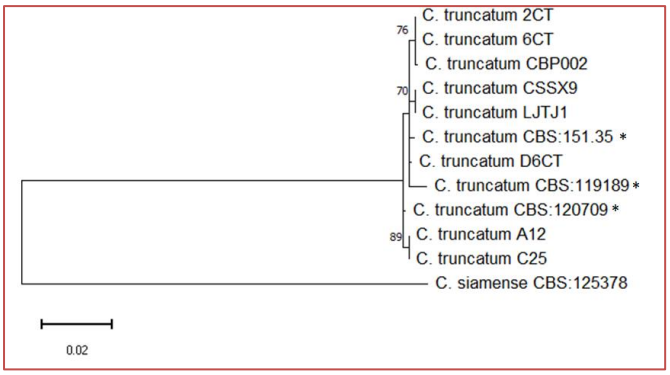


Figure 19. Phylogeny tree of Colletotrichum truncatum isolates

The Phylogeny tree of Colletotrichum truncatum isolates from a concatenated sequences of internal transcribed spacer (ITS) region and actin (ACT), β-tubulin (TUB2), glyceraldehyde 3- phosphate dehydrogenase (GAPDH) genes using maximum likelihood analysis in MEGA11 is given in Fig. 19 wherein Bootstrap values >50% (1000 replication) are given at the nodes. C. siamense CBS: 125378 is used as the outgroup, epitype cultures are indicated by asterisks. Isolates 2CT, 6CT and D6CT were collected during the study.

Genotypes with high stem reserve mobilization can overcome impact of rust on chickpea yield

Gurumurthy S, Scientist, Plant Physiology

Chickpea is one of the major pulse crops cultivated worldwide. It is affected by many fungal diseases including rust caused by the fungus Uromyces ciceris arietini. Its severity was mainly observed during the flowering and pod development stage and this causes considerable yield losses. The investigation was carried out at ICAR-NIASM, during 2021-2022 to assess genotypic variation stem reserve mobilization (SRM) and its influence on loss of grain yield due to rust infection on the basis of the severity of rust, seed yield, test weight.

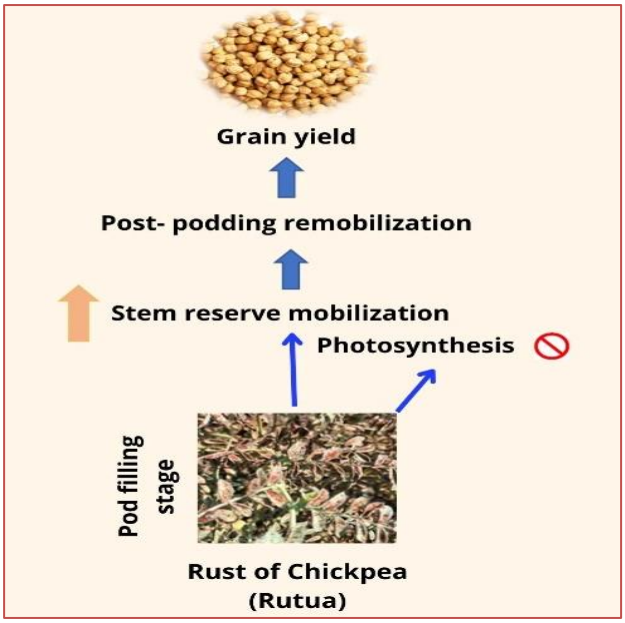


Figure 20. Proposed model for stem reserve mobilization (SRM) during pod filling stage under rust infection

The SRM was strongly correlated (R^2= 0.96) with yield irrespective of the severity of rust infection. Phule Vikram, a local chickpea genotype, recorded the highest grain yield (1506.6 kg/ha) and SRM (23.65 mg/g stem dry weight) while the lowest yield was recorded in Pusa Green 112 (476.7 kg/ha), a sensitive, genotype that had less SRM (3.44 mg/g stem dry weight) and partially filled

grain. The results indicated that SRM has a major role in ensuring pod filling even under rust infection. Hence, it is suggested that the emphasis should be on SRM as a trait for selection of early generation breeding lines in the chickpea improvement program with precaution to reduce a penalty if any in terms of attraction of pests by increased access to soluble sugars in high SRM genotypes.

Identification of fruit size and quality enhancing dragon fruit clones and its adoption

KM Boraiha, Scientist, Genetics and Plant Breeding

Two dragon fruit clones were identified that enhanced the fruit size and quality of fruit upon use of their pollen for pollination. The average weight of fruit obtained are listed in Table 1.

Table 1. Effect of pollen on fruit size (average weight in grams) in dragon fruit.

Pollen parent	Female parent			
	NIASM DFR-1	NIASM DFW-1	NIASM DFW-2	DDFW-1 Farmer field
NIASM DFR-1	-	500 gm	465 gm	425 gm
NIASM DFW-2	-	430 gm	-	-

Technology dissemination and adoption:

Several white fleshed dragon fruit growing framers including Mr. Thanaji Devkar from Neemgaon, Indapur, MH reported undersize fruit formation and flower drop due to occurrence rainfall coinciding with anthesis.

Figure 21 (a.) Mr. Thanaji Devkar, farmer following supplementary pollination showing cross pollinated fruits

(b). Fruits size after (A) natural pollination, (B) hand cross pollination and (C) hand self-pollination

The hands on training on emasculation and pollination in dragon fruit resulted in average weight of 250 gm, 315 gm and 425 gm in natural, self and cross pollinated treatments, respectively for 30 fruits sampled per treatment (Fig 21b). The fruit size in cross pollination was almost doubled compared to natural pollination and is primarily due to pollen effect of male clone (designated as NIASM DFR-1) used for pollination. Similarly, Mr. Ganesh Taware, a dragon fruit farmer who reported pollen wash out in his red fleshed dragon fruit orchard because of rainfall used supplementary pollination to ascertain getting better fruit size and quality dragon fruits.

Genetic garden accessions and observations on variations in Chia mutants

KM Boraiha, Scientist, Genetics and Plant Breeding

Multiplication, maintenance and documentation of the germplasm of finger millet (77 accessions), foxtail millet (118 accessions), groundnut (174 accessions and seven varieties), cowpea (250), pigeon pea (141) and mung (250) were carried out. Multiplication and grouping of groundnut accessions (181) based on days to 50 % flowering (DFF) and branching habit was done. Out of 181 accessions, 86 are bunchy type. Among bunchy type 40 accessions are early (DFF: <28 days), 30 medium (DFF:29-31 days) and 16 late flowering (DFF: >32). The bunchy type accessions will be used for screening in the kharif 2022 under rainfed condition. Also genetic variation for chlorophyll and yield attributing traits in foxtail millet accessions (118) grown under nutrient poor (NPK) soils was observed.

Figure 22. a) Early maturing mutant b) Mutant with triple radial branching

Observations were recorded on variations for agronomical and morphological traits in chia and Quinoa mutants (obtained through γ radiated seeds). The mutants with variations were observed in Chia for more than one trait. In some mutants changes were observed for 4 characters. The frequency of mutation ranged from 0.0097 to

0.1065 % and out of three dose of gamma radiation, more number of mutants were observed in 500 Gy, whereas chlorosis related mortality was more in 600 Gy. 300 M2 mutants have been selected for advancing to M3 generation during 2022. Among all, special trait mutant plant with triple radial branching pattern was identified in comparison to paired branching in wild plants.

Nursery raising protocol for chia for rapid multiplication

Harisha, Scientist, Spices, Plantation, Medicinal & Aromatic Plants

Chia nursery raising technique was standardized using different growing media combinations (cocopeat, soil, vermicompost, perlite and vermiculite) along with four tray sizes (18.7 cc, 21.6 cc, 37.2 cc and 61.4cc) and three stages of transplanting; 10, 15 and 20 days old seedlings. The tray size of 37.2 cc with 50 cells found better in terms of growth and vigour of seedlings and it holds optimum growing media which helps in easy transplanting in field condition. Field transplanting of 15 days old seedlings showed good establishment rate (98.9%) as compared to 10 days old seedlings (85.2%). Among growing media combinations, cocopeat + vermicompost + soil (1:1:1) found suitable and produced higher shoot length, seedling vigour index and dry weight as compared to soil, cocopeat and vermicompost alone.

Table 2: Effect of growing media on seedling growth and field survival of chia

Growing media	SVI-1	Shoot length (cm)	Root length (cm)	Field Survival (%)
Soil alone	1072.3d	4.09d	7.29d	65.2d
CP alone	1457.4c	5.51c	9.43c	84.5bc
VC alone	1650.1a-c	6.68ab	10.25bc	79.7c
CP+Soil	1724.8ab	6.64ab	10.88ab	93.5a
Vc +Soil	1804.7ab	6.70ab	11.74a	90.8ab
Cp+VC	1754.0ab	6.64ab	11.23ab	92.2a
Cp+Ver+Per	1647.0a-c	5.95bc	10.83ab	95.6a
VC+Ver+Per	1615.2bc	5.93bc	10.34bc	96.2a
Cp+VC+Soil	1870.3a	7.08a	11.80a	96.8a
CP+VC+Pr+Vr	1841.8ab	6.79ab	11.79a	96.3a
P value	<.0001	<.0001	<.0001	<.0001

Therefore, the media combination of cocopeat + vermicompost + soil (1:1:1) with 37.2 cc tray size was ideal for chia germination and transplanting of 15-20 days old seedlings showed better establishment and subsequent growth in field condition. This could help in saving seeds, time and production resources required for chia establishment under direct field conditions. These seedlings could be used for rapid multiplication of elite genotypes in breeding or hybridization programmes without loss of seedling viability.

Table 3: Effect of tray size and growing media on seedling growth and field survival of chia

Cell volume	Shoot length (cm)	Root length (cm)	SVI-I	Field survival (%)	Absolute growth rate (mg/day)
18.7cc	5.5b	8.4d	1392.7d	97.2b	1.08d
21.6cc	5.8b	10.0c	1587.6c	97.0b	1.21c
37.2cc	11.3a	10.9b	2222.8b	99.3a	1.58b
61.4cc	11.1a	12.0a	2309.8a	99.2a	1.90a
P value	<.001	<.001	<.001	<.001	<.001
Media combinations					
CP+VC+Soil	8.6a	10.3a	1897.4a	98.1a	1.56a
Cp+VC+Vr+P	8.2b	10.4a	1864.0a	98.3a	1.40a
CP+VC	8.4ab	10.3a	1872.8a	98.1a	1.37a
P value	0.053	NS	NS	NS	NS

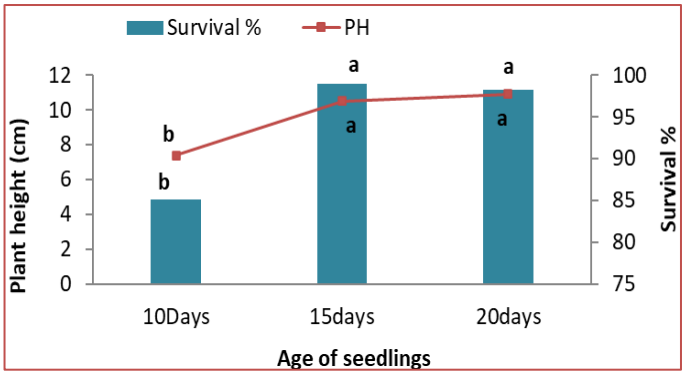


Figure 23. Survival % and growth of transplants in field

Intercropping of soybean with sugarcane in spring season for area expansion in India

HM Halli, Scientist, Agronomy; Raghavendra M, Scientist, IISR-Indore; Rajagopal V., Scientist, Soil Chemistry/Fertility/Microbiology

In India sugarcane is being cultivated in an area of 45.7 lakh hectares, out of which southern states (Karnataka and Maharashtra) solely contribute around 29.8% area. These states also have suitable weather conditions for soybean cultivation during off-season (spring) thereby allowing soybean as an intercrop with sugarcane. Soybean can be sown on the day or the next day of sugarcane planting for better management. This intensification aids to get an additional yield advantage and income to sugarcane farmers at an early stage of cane without curtailing yield and soil fertility. In this context, an experiment to evaluate suitability and yield

potential of new soybean genotypes an intercrop in sugarcane during off-season in Uttar Pradesh, Karnataka, Maharashtra was initiated by ICAR-Indian Institute of Soybean Research, Indore. A part of this study, with five soybean genotypes sown as intercrop in the farmer's sugarcane field (Jalgaon, Baramati, Maharashtra, Lat 18.23231° and Long 74.486746°) on 6th March 2022 in medium-deep black soils was also undertaken.

Results revealed that all the soybean genotypes performed comparatively superior during off-season without much yield loss (Fig.25). These genotypes differed significantly ($p<0.005$) with respect to growth and yield attributes. Genotypes, YMV-11 (18.3 g/plant), NRC-130 (17.66 g /plant), and NRC-131 (18.10 g/plant) produced higher and comparable total aboveground biomass compared to JS-20-34 (15.76 g/plant) and NRC-136 (11.60 g/plant) at 90 days after sowing (Fig. 24). Consequently, a greater grain yield was recorded in the descending order of genotypes; YMV-11 (14.10 q ha^{-1}) > NRC-131 (12.96 q ha^{-1}) > NRC-130 (12.30 q ha^{-1}) > JS-20-34 (11.06 q ha^{-1}) > NRC-136 (10.23 q ha^{-1}) as per Fig. 25.

Figure 24. General view of soybean genotypes as intercrops in sugarcane at 90 days after sowing

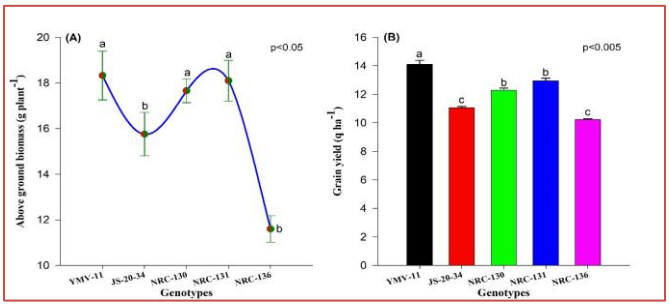


Figure 25. Growth and yield of soybean genotypes as intercrops in sugarcane

Despite, late sowing (1st week of March), rapid coverage of sugarcane canopy, and higher temperature during reproductive stages, these genotypes showed the potential to perform better as an intercrop in sugarcane. Therefore, this belt of sugarcane would be the potential option to expand the soybean area under cultivation without much loss in the sugarcane yield and also act as a climate-resilient strategy to increase soybean production.

Performance of lemongrass in Sandalwood-Tamarind agroforestry systems

SB Chavan, Scientist, Agricultural Forestry

The growth of the lemongrass was studied after 6 months of establishment. Parameters on number of tillers, herbage yield per clump, oil content and yield per ha were quantified. This is at the establishment phase so statistical non-significant results are obtained in the case of Height (cm) & tillers. However, clump herbage yield & oil content was significantly varied within the different planting treatment. The per clump yield of lemon grass varies from 480-532 g. On hectare basis, the average yield of lemon grass was 8 .37 tonnes. The oil content varies from 0.49 to 0.65 %. These are preliminary results of the establishment phase. The effect of spacing and planting sandalwood will be realized in later years.

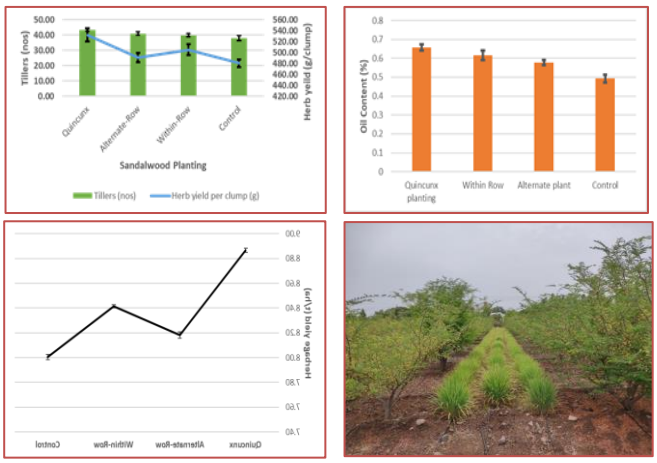


Figure 26. Number of tillers, herbage yield and oil content of lemon grass grown in Sandalwood-tamarind

Biomass equation & Carbon storage in Melia dubia from farmers field

SB Chavan, Scientist, Agricultural Forestry

The field sampling of Melia dubia trees through destructive sampling was carried out in Solapur districts of Maharashtra to develop biomass estimation models for carbon sequestration studies. The DBH values of the harvested trees ranged from 16.69 to 26.75 cm and tree heights of 15.55 to 18.90 m. The independent parameter (DBH & tree height) was plotted against dry bole weight of Melia trees to testify to the regression relationship. The diameter at breast height was found to be the best independent predictor over tree height.

Figure 27. Biomass model, Biomass accumulation, carbon stock in Melia dubia

The best regression equation was found to be power (Allometry) equation i.e. Above ground Biomass (kg tree^{-1}) = 0.4857×(DBH)$^{2.0428}$ with R^2 of 0.97. Mean absolute error (MAE) for the best-fit model is 10.22 indicating that error of only 10.22 Kg may occur in the prediction of aboveground tree biomass of Melia. The average biomass and carbon stock of Melia was 176.45 per kg per tree and 83.68 kg tree^{-1}.

Performance and production of various Fodder-based systems in CIFS

SB Chavan, Scientist, Agricultural Forestry

Fodder requirement is the most crucial aspect of agricultural-based livelihood. Various fodder systems such as Moringa-Napier, Pomegranate-Lucerne, Custard apple-Lucerne and boundary-based fodders were established to fulfil the fodder requirements of animals in CIFS. Out of five fodder systems, the Lucerne-fruit system and Napier-Moringa silvipasture systems provided about 29 and 28 % of total fodder, respectively. Animal-wise fodder consumptions from different fodder systems were also analyzed and are presented in the following figures.

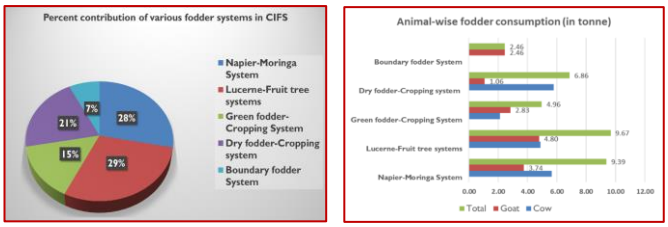


Figure 28. Percent contribution of Fodder systems in CIFS (a); Animal-wise fodder consumption (b)

NEW INITIATIVES

Installation of Automatic Weather Station

Automatic Weather Station (AWS) was installed at NIASM Agromet observatory in collaboration with India Meteorological Department (IMD). It logs the real-time weather data of important parameters viz. rainfall, air temp, RH, wind direction, wind speed and air pressure every 15 min and are also updated on NIASM website every fifteen minutes.

Extension of Goat Shed in Experimental Livestock Unit

Considering the importance of goats in climate resilient food production system there is need to upgrade the experimental goat unit to accommodate more goat breeds for studying their comparative thermos-tolerance abilities. Therefore, the goat unit with four compartments was extended to ten compartments.

Inauguration of Varun: an automated irrigation and fertigation facility

Automated irrigation and fertigation system is installed at a Pump House near Manas Pond. It consists of Filtration system, Fertilizer tanks, Fertigation System, Main control unit and distribution lines. The solenoid valves placed at each field can be operated remotely by Automated Irrigation and Fertigation System through the program determined on the basis of crop water requirements.

MAJOR EVENTS

Celebration of "Swachhata Pakhwada" campaign at ICAR-NIASM

"Swachhata Pakhwada" was celebrated from 15th December 2021 to 02th January 2022. All the staff participated in 'Swachhata Pledge', led by Dr. Himanshu Pathak, Director. More than 100 participants, including the staff and farmers, watched the Hon'ble Prime Minister's Address on Natural Farming (virtual mode). Activities of weeding out old files/records, disposing of old and obsolete furniture's, junk materials, etc. were reviewed. Essay Writing and Quiz completions were conducted for the staff. A cleanliness awareness programme was organized at Primary school, Malegaon Khurd on 28th December 2021. The institute staff along with Malegaon Khurd villagers participated in a cleanliness drive at the temple premises, gram Panchayat and public roads.

Celebration of New Year-2022

Recreational and Welfare committee organized programme on new year. Dr. Himanshu Pathak, Director, welcomed arrival of new year with great passion and enthusiasm. Five publications, viz., Annual Report-2021, Newsletter April-December 2021, Farm Coordinator-December 2021, Project Coordinator-December 2021, Suflam Hindi magazines-2021, were released on the ocassion. Various awards were distributed for the Swachhata Pakhwada and staff Cricket tournament.

One-day farmers training on multifunctional ratoon drill (MRD)

A one-day farmers' training cum field demonstration on "Sugarcane ratoon and trash management techniques and machinery use" was held at Sangavi village, Satara, on 07 January 2022. The training was organized by Agriculture Technology Management Agency (ATMA), in collaboration with ICAR-National Institute of Abiotic Stress Management, Malegaon, Baramati, and College of Agriculture, Baramati. More than 60 sugarcane farmers, state officials and entrepreneurs were participated in the programme.

One-day training cum field demonstration on "Conservation agriculture for sugarcane and water stress impacts in vegetables crops"

One day training cum field demonstration on 'Conservation agriculture for sugarcane and water stress impacts in vegetables crops' was organized by ICAR-NIASM on 20th January 2022. Team of 70 progressive sugarcane farmers and agricultural officials from the state agriculture department, Paithan and Phulambri Tehsils of Aurangabad district participated in the field training. The farmers were introduced about conservation agriculture, sugarcane copping system and water stress in vegetable crops and demonstration of the fields plots under conservation agriculture and vegetable experiments was done.

Celebration of 73rd Republic Day 2022

ICAR-NIASM celebrated 73rd Republic Day on the 26th January 2022. Scientists, Technical, Administrative, Senior Research Fellows, Young Professionals and supporting staff participated in the event. The celebration started with the hoisting of the National Flag by the Director, Dr. Himanshu Pathak. In his speech, the director highlighted the importance of the day and expressed his gratitude to all those who contributed to the national development.

Visit of Hon'ble Sharad Pawar, Former Cabinet Minister of Agriculture and MP, Rajya Sabha

Hon'ble Sharad Pawar, Former Cabinet Minister of Agriculture, Govt of India and currently Member of Parliament, Rajya Sabha visited the Institute on 3rd February 2022. Dr. Himanshu Pathak, Director welcomed him along with the other distinguished guests. Dr. Pathak highlighted the achievements of Indian agriculture over the years and the role of abiotic stress management for sustainable agriculture. He also presented the achievements of ICAR-NIASM in the areas of research, teaching, and extension. Sh. Pawar appreciated the activities of the Institute and gave his suggestions and blessings for the future activities of the institute.

Celebration of World Pulse Day

ICAR-NIASM celebrated World Pulse Day on 10th February 2022. A Quiz competition on Pulse Crops was conducted wherein 30 Young Professionals/SRF/Students participated. On the occasion, a series of lecture were organized namely, 'Overview on pulse production in India' by Dr Boraiah, 'Biotechnological interventions in pulse crops improvement, by Dr. A.K. Singh, "Status of pulse crops in Maharashtra' by Dr N.S. Kute, MPKV, Rahuri, and 'Advances in agronomy of pulses' by Dr Aliza Pradhan. Dr Jagadish Rane shared important facts about pulses and their. role in nutritional security. Dr Himanshu Pathak, Director, ICAR-NIASM in his concluding remarks emphasized the nutritional importance of pulses and highlighted strategies to enhance the productivity and nutritive value of pulse crops. Mr Ashok Taware, a progressive farmer shared his practical experience of pulse production.

Krushik: Agricultural Technology Week 2022

Krushik: Agricultural Technology Week 2022 was jointly organized by ICAR-NIASM and KVK, Baramati form 9 to 13 February 2022. About 2000 farmers visited ICAR-NIASM to witness the live demonstrations and the experimental plots during the event. Dr. Himanshu Pathak, Director, ICAR-NIASM discussed with students as well as farmers about climate resilient technologies at ATIC NIASM. The Krushik 2022 generated enthusiasm among farmers/ visitors particularly for the abiotic stress management options specially climate resilience genotypes, varieties, horticultural crops as well as technologies, different farming systems.

Celebration of 14th Foundation Day

ICAR-NIASM celebrated 14th Foundation Day on 21st February 2022. Dr. Trilochan Mohapatra, Secretary, DARE and Director General, ICAR, Ministry of Agriculture and Farmers Welfare, Government of India was the Chief Guest; Dr. S.K. Chaudhari, DDG (NRM) Guest of Honour and Dr. T.A. More, former Vice Chancellor of MPKV Rahuri was the Special Guest. Dr. Himanshu Pathak, Director, NAARM delivered the welcome address and briefed the achievements of the Institute. Dr. S.K. Chaudhary, DDG (NRM) gave insights about the institute journey in last decade in development and research fronts. He congratulated ICAR-NIASM for the achievements in the area of Abiotic stress and wished a long success ahead. Dr. Mohapatra virtually inaugurated the Hostel facilities (Konark-Men & Koyana-Women) of ICAR-NIASM. He told that under the scenarios of changing climate institute like ICAR-NIASM has to play significant & lead role in Indian agriculture. Dr T.A. More delivered the Foundation Day Lecture on "Fruit and Vegetable in Arid zone: Abiotic Stress Management". The function was attended by DDGs & ADGs of Headquarter, Directors of the different ICAR institutions, Scientists through online virtual mode and the NIASM staff, guests, invited farmers and dignitaries physically. Dr Jagdish Rane proposed the vote of thanks. On the ocassion, Award Function was organized to felicitate progressive farmers, NIASM staff, contractual (YPs, Skilled labour & Security) staff, NAC associates and sports awardees, Mrs Smita Kale, CEO of Malegaon Nagar Panchayat was invited as the special guest for the event. Cultural event was organized in the evening.

Celebration of National Science Day and inauguration of short course on "Advances in application of Phenomics Tools for Assessment of Abiotic Stress Responses of Crop Plants"

ICAR-NIASM celebrated National Science Day, on 28th February 2022. Dr. S.D. Sawant, Hon'ble Vice Chancellor, Dr. Balasaheb Konkan Krishi Vidhyapeeth , Dapoli, was the Chief Guest of the function and Dr. Himanshu Pathak, Director, NIASM chaired the programme. Dr. Sawant urged to inculcate scientific temper among individual and suggested the scientific community to work towards benefit of the social welfare and farming community. Dr. Himanshu Pathak briefed the house about Raman Effect and its significance in day to day life and science and also highlighted the contribution of Indian science at international level. Dr. Jagadish Rane, Course Director briefed about the short course on "Advance in Plant Phenomics Tools". About 13 participants from different state agricultural universities and ICAR Institutes are participating in this training program.

Celebration of International Women's Day.

On the occasion of International Women's Day on 8th March, 2022, Women Health Camp was organized at ICAR-NIASM. The programme was initiated with the felicitation of chief guest Smt. Rohini Taware (Member, Zilha Parishad, Pune) and Smt. Sangita Patole (President, Samajik Nyay Vibhag, Baramati). Initially Dr. Vanita Kokare (BAMS, DGO), Medical officer attached with ICAR-NIASM, addressed the importance of woman health in day to day life. "The programme was followed by an online lecture from Dr Amelia Henry, renowned women scientist from International Rice Research Institute, Philippines on "Phenotyping Rice for drought tolerance".

Exposure visit cum interaction meeting of NABARD officials

Exposure visit cum interaction meeting of NABARD officials was organized at ICAR-NIASM. Shri. G.S Rawat, Chief General Manager, NABARD, Maharashtra Regional Office, Pune, along with his team of AGM, DGM and DDMs visited ICAR-NIASM on 11th March 2022. The visit was aimed towards understanding various technologies related to smart agriculture, Remote sensing technologies in agriculture, Agroforestry system models, aquaculture models and Integrated farming systems. The interaction session between the team of NABARD and Scientist from ICAR-NIASM explored possibilities of collaborative work in the areas of Agroforestry, Geo-spatial data exchange, development activities at Nandurbar District, Climate Smart-Integrated farming Systems (CIFS) and bringing resilience to soybean cotton cropping systems in Vidharba region of Maharashtra, Silage formulations from sugarcane tops in drought stressed areas, and management strategies in salinity stressed sugarcane belt of Kolhapur District of Maharashtra.

Field visit of students to CRPCA and demonstration of MRD Machine

On 15th March 2022, a group of 60 students from College of Horticulture, Mulde, under Dr. Balasaheb Sawnt Konkan Krishi Vidyapeeth, Dapoli visited CRP-CA fields of ICAR-NIASM. They were briefed about the conservation agriculture, its relevance under climate change scenario, trash management through MRD machine, benefits of conservation agriculture practices highlighting effect of residue cover on soil health and soil microbial biomass. The visit and demonstration was followed by an interactive session where students clarified about several aspects of conservation agriculture, trash management, irrigation management in sugarcane and cost effectiveness of MRD machine.

One Day Training-cum-Demonstration on "Climate-resilient Backyard Poultry Farming"

ICAR-NIASM organized a Training Programme on "Climate-resilient Backyard Poultry Farming" on 19th April 2022 under DAPSC. Three lectures were delivered during the technical session: 'Management of Backyard Poultry birds', 'Diseases of Poultry, and 'Summer management of Poultry'. The beneficiaries were briefed on how best the benefits of backyard poultry farming can be derived besides updating the farmers about the various types of poultry farming. About 70 beneficiaries benefitted from this training programme. Grampanchayat members and social workers also participated in the training programme. The training programme was followed by the demonstration of backyard poultry rearing and distribution of Backyard Poultry Cages and Poultry birds to the identified beneficiaries in different villages, namely Gholapwadi, Visapur, Borivel and Baramati.

One Day Field Training cum Frontline Demonstration of Intercropping Using MRD Machine in Ratoon Sugarcane

ICAR-NIASM organized one day field training cum frontline demonstration of sowing of kharif intercrops viz., soybean and chickpea in late harvested ratoon sugarcane of farmers' fields at Malegaon, Kh, Baramati on 20th April 2022. About 45-50 sugarcane farmers, scientists, students and visitors were participated in the event. During the programme, the participants were briefed about the

mitigation strategies for alleviating the abiotic stresses in sugarcane including conservation agriculture, the benefits CA and importance of MRD machine for performing various operations viz., stubble shaving, off-barring/pruning, fertilizers cum seed application in trash retained fields, the benefits of intercropping like soybean for improving nitrogen fixation, soil heath and soil biota in ratoon sugarcane and summer chickpea which can be an alternative intercrop in ratoon sugarcane.

One Day Training cum Demonstration on "Organic Nutrient Management for Sustainable Crop Production"

ICAR-NIASM organized a Training Programme on "Organic nutrient management for sustainable crop production" on 23rd April 2022 under DAPSC at: Kadamwadi Village of Malshiras tehsil under Solapur district. Three lectures were delivered during the technical session: 'Vemicomposting for sustainable crop production', 'Compost: a critical component of organic farming' and 'Dragon fruit cultivation and demonstration'. The farmers were demonstrated the use of vermicomposting units for preparation of vermicompost and cultivation of dragon fruit in degraded lands or as backyard activity. About 75 beneficiaries were benefitted from this training programme. A few Grampanchayat members/social workers also participated in the event. The training programme was followed by the distribution of Vemocomposting units, cement poles along with dragon fruit cutting for dragon fruit cultivation to the identified beneficiaries.

Workshop on AGROTAIN Incorporated Urea Produced with N-TEGRATION Technology

ICAR-NIASM in collaboration with CIMMYT, India and ICAR-CSSRI, Karnal organized an international workshop on AGROTAIN Incorporated Urea Produced with N-TEGRATIONTM Technology to address fertilizer use efficiency in major cropping systems of India during 27-28 April, 2022 at ICAR, NIASM, Baramti. The workshop was inaugurated on 27th April, 2022 by Dr M.L. Jat, Principal scientist and system agronomist, CIMMYT, Nepal and chaired by Dr Himanshu Pathak, Director, ICAR-NIASM along with Dr. H S Jat, Principal Scientist and overall principal investigator of the project, ICAR-CSSRI, Karnal and Dr D. S. Rana, senior agronomist, CIMMYT, India. A plenary session was organized on 28th April, 2022 where Dr. S.K. Chaudhari, DDG (NRM), ICAR was the chief guest along with other dignitaries like Dr Himanshu pathak, Dr ML Jat and Dr HS Jat. Professor JK Ladha, Adjunct professor, University of California, Davis, Dr Greg Schwab and Dr Ashish Aggrawal from Koch Agronomic Services, graced the occasion through online mode. Around 150 participants including scientist, technical and administration staff, students and research scholars attended the plenary session in a hybrid mode.

Visit of Hon'ble Deputy Director General (NRM), ICAR

Hon'ble DDG (NRM), ICAR, Dr SK Chaudhari visited ICAR-NIASM on 28th April 2022. Dr. Himanshu Pathak, Director, ICAR-NIASM welcomed him along with other dignitaries; Dr ML Jat, Dr DS Rana from CIMMYT; Dr HS Jat, ICAR-CSSRI, Karnal and other distinguished scientists from ICAR institutes (IISS, Bhopal & IIWM, Bhubaneshwar), BISA (Ludhiana and Samastipur), PJTSAU, Hyderabad. The program began with a visit to NIASM fields and institute facilities and infrastructures followed by an interaction meeting with all the NIASM staff. The

Director, Dr Himanshu Pathak updated Hon'ble DDG (NRM) about recent achievements and the ongoing research, academic and extension activities of the institute. Dr SK Chaudhari also participated in distributing inputs to some SC beneficiaries under DAPSC programme of the institute. The DDG (NRM) appreciated the ongoing activities of the institute in the area of abiotic stress management and wished a long success ahead.

One Day Training-cum-Demonstration on "Dragon fruit cultivation in degraded land and kitchen garden"

ICAR-NIASM organized a Training-cum-Demonstration on "Dragon fruit cultivation in degraded land and kitchen garden" on 30th April 2022 DAPSC at Rakshaswadi Bk Village of Karjat tehsil under Ahmednagar district. Two lectures were delivered during the technical session: 'Dragon fruit cultivation and its demonstration' and 'Tools and implements used in Agriculture' along with demonstration on installing dragon fruit poles, rings, and planting dragon fruit cuttings in degraded lands or as backyard activity. About 100 beneficiaries and farmers were benefitted from this training programme. Sarpanch and other dignitaries from Grampanchayat also participated in the event. The training programme was followed by the distribution of cement poles along with dragon fruit cuttings for dragon fruit cultivation and tool kit for daily use in agriculture to the identified beneficiaries.

Training-cum-Demonstration programme on "Climate Resilient Dairy Production"

ICAR-NIASM organized a Training Programme on "Climate Resilient Dairy Production" on 6th May 2022 under DAPSC at ICAR-NIASM. Dr Himanshu Pathak, Director ICAR NIASM, in his inaugural address, narrated about implications of climate change in agriculture and importance of continued alliance of beneficiaries with institute for further way outs. Three lectures were delivered during the technical session: 'Nutritional management for climate resilient Dairy animal production', 'Important diseases of dairy animals and its control' and 'Management of Dairy animals under heat stress'. About 75 were beneficiaries benefitted from this training programme. A few Grampanchayat members/social workers also participated in the training programme. The training programme was followed by the distribution of Dairy kit to the identified beneficiaries in different villages, namely Sansar, Gholapwadi, Mankarwadi, Gojibavi, Nirawagaj, Boribel, Baramati, etc.

Training program on "Climate-smart agriculture (CSA)"

Aligned with the vision of Prime Minister Narendra Modi who recently called for an alliance of scientists and farmers to deal with climate change, and ensure a green future, Environmental Defense Fund (EDF) in collaboration with Syngenta Foundation India (SFI) and ICAR-NIASM has launched a unique program on "Climate-smart agriculture (CSA)" organized at ICAR-National Institute of Abiotic Stress Management (NIASM), Baramati Maharashtra-India during 16-21 May 2022 to educate and build the capacity of the leadership team of SFI. More than 30 participants from SFI, Pune; staff of NIASM and KVK, Baramati participated in the training.

One day Training programme on "Upliftment of livelihood of SC Beneficiaries"

ICAR-NIASM organized a Training Programme on "Upliftment of livelihood of SC Beneficiaries" on 31st May 2022 under DAPSC at Visapur village of Satara District, Maharashtra. Lectures were delivered on 'Nutritional management in livestock', 'Silage making and importance of backyard poultry' and 'Safety measures to be taken during plant protection operations and Mechanization in agriculture,. About 80 beneficiaries benefitted from this training programme. Grampanchayat sarpanch and the members/social workers from the village actively participated in the training programme. The training programme was followed by the distribution of inputs like sewing machine, domestic flour mill, bicycles, utensil kit and Covid-19 kit to the identified beneficiaries' of Visapur village.

Short Term Course on "Abiotic Stresses in Agriculture: An Introduction and Hands-on Training for Skill Development"

ICAR-NIASM organized a "Abiotic Stresses in Agriculture: An Introduction and Hands-on Training for Skill Development, (1 June to 10 July 2022)" for students, young professionals and researchers across the different agriculture disciplines including agricultural engineering. Dr H. Pathak, Director, ICAR-NIASM, Chief Guest of the programme has delivered talk on "Climate Change and managing abiotic Stresses in Agriculture". Dr Jagadish Rane talked on importance of skill development programme for managing abiotic stresses in agricultures. Total 41 trainees attended the programme.

12th Institute Research Council (IRC) meeting

12th IRC meeting of ICAR-NIASM was held on June 15-16, 2022. Dr Himanshu Pathak, Director, NIASM chaired the meeting. Dr M Maheshwari, Former Head, Division of Crop Improvement, ICAR-CRIDA; Dr Pradip Dey, Principal Scientist and PC (STCR), ICAR-IISS, Bhopal; Dr M S Meena, Principal Scientist, ICAR-ATARI, Jodhpur and Dr S K Das, Principal Scientist, ICAR-IVRI participated the meeting as resource persons in different disciplines in person. Dr N P Sahu, Joint Director, CIFE, Mumbai and Dr S R Gadakh, Director Research, MPKV Rahuri participated online. Dr Pathak briefed the achievement of the institute during the year. The action taken report of 11th IRC recommendations was presented by Dr Jagadish Rane. The achievements of the Schools were presented by Head of the respective Schools followed by presentation of Flagship, Umbrella and In-house projects by respective principal investigators. All the experts have put their suggestion for improvement of all the projects. The field visit was conducted on 16th June 2022, where all the scientists explained their field research.

ICAR-University-NAAS-Stakeholders Interface Meeting

ICAR-NIASM conducted ICAR-University-NAAS-Stakeholders Interface Meeting on 17th June 2022. Hon'ble Vice Chancellor Dr VM Bhale, PDKV, Akola and Dr Y S Nerkar, Former Vice Chancellor MPKV Rahuri Co-Chaired the meeting. Dr SD Sawant, Vice chancellor, BSKKV, Dapoli; Dr PK Patil, Vice chancellor, MPKV, Rahuri; Directors of ICAR Institutes located in Maharashtra and their representatives; progressive farmers; private sectors; NGOs and KVK participated in the meeting. Senior NAAS Fellows and Associates also attended meeting in person or online. Dr Himanshu Pathak, Director, ICAR-NIASM introduced the background and objectives of the meeting. The meeting aimed to strengthen the bonding among SAUs, ICAR, private companies, NGOs, KVKs, NAAS and the farmers to develop need-based technologies to uplift farmers' livelihood and enhance the resilience against climate change. On the ocassion, a book on 'Abiotic Stress in Agriculture: Impacts and Management' by ICAR-NIASM and three policy papers by Pune Chapter of NAAS were released.

Awareness Programme on "Protecting Rights in Areas of Farm Innovations, Breeding and Protection of Varieties"

An awareness programme "Protecting Rights in Areas of Farm Innovations, Breeding and Protection of Varieties" was organized on 20th June 2022 at ICAR-NIASM to create awareness amongst farmers for protection of plant varieties, the rights of farmers and to encourage the development of new varieties of plants. On this occasion, Dr. Himanshu Pathak, Director, ICAR-NIASM stated that the farmers are trying to cultivate traditional crop varieties for years and these should be protected by farmers. Dr. Shivaji B. Gurav, Former Dy. Registrar, PPV&FRA, Pune branch, emphasized various aspects of PPV&FRA. Dr. Gurav also gave detailed information about the process of registration of plant varieties. Dr. Boraiah Scientist, ICAR-NIASM, emphasized the importance of farmers varieties. About 200 participants including 100 farmers from Vidarbha region of Maharshtra (Yavatmal, Nagpur, Akola, Indapur, Baramati and Malegaon) along with scientists, technical and administrative staff, students, YPs, and SRFs participated in this awareness Programme.

Farmers' Awareness Campaign on Efficient and Balanced Use of Fertilizers

To celebrate 75 years of India's Independence, farmers' awareness campaign on 'Efficient and balanced use of fertilizers' was organized at ICAR-NIASM Baramati on 21st June 2022. Dr Himanshu Pathak, Director was the Chief Guest of the function. Three lectures were organized on the ocassion namely, 'Role of fertilizers in supply of plant nutrients, judicious use of fertilizers using 4R approach and importance of organic fertilizers', "Crop residue management' and 'Trash management and machinery for conservation agriculture in ratoon sugarcane cropping system' On the occasion agricultural inputs such as drip fertigation system and flour mills were distributed to the farmers under SCSP scheme (Consortia Platform on Conservation Agriculture).

Celebration of International Day of YOGA.

On the eve of 8th International Day of Yoga, various activities were carried out at ICAR-NIASM. 'Common Yoga Protocol Leaflets' in Hindi and English were circulated to the staff members. On 21st June 2022, the day celebration started with mass practicing of YOGA from 7.30 am to 9.00 am at the Amphitheatre of the Institute. The Director, Dr. Himanshu Pathak introduced the program with brief information on 'Ashtang Yoga' and its importance in every day life. Dr. Pravin Taware (ACTO) demonstrated the various asanas as per Common Yoga Protocol designed by the Ministry of AYUSH. A motivational lecture was delivered by Spiritual leader Shri. Nanda Dulal Das from ISCON, Mumbai. All the institute staff participated the program with enthusiasm.

LIST OF ONGOING PROJECTS

Umbrella Projects

1. Climate resilient integrated farming system for semi-arid regions.
2. Genetic garden and gene bank for abiotic stress tolerant plants, animals and fisheries for food security and sustainability.
3. Geo-spatial digital maps of multiple abiotic stresses, their future scenarios and management options.
4. Environment-friendly, economically viable, state-of-the-art model farm for abiotic stressed regions.

Flagship Projects

1. Adaptation and mitigation of atmospheric stresses in crops (chickpea, soybean); goat; poultry and fish for sustainable productivity and profitability.
2. Augmenting farm income in water scarce regions with alternative crops.
3. Targeting prospective technologies for abiotic stress resilience in rainfed and dryland regions.
4. Amelioration of saline lands in arid and semi-arid regions with halophytes and associated microbiome.

Institute Projects

1. Mitigating water stress effects in vegetable and orchard crops.
2. Assessment and detoxification of heavy metals in aquatic water bodies using nutritional approaches.
3. Nutrient and gene interaction approaches through nutrigenomics in response to multiple stressors.
4. Wastewater treatment synergizing with integrated approach of constructed wetland and aquaponics.
5. Genomics, genetic and molecular approaches to improve water stress tolerance in soybean and wheat.

Externally Aided Projects

1. Genomics strategies for improvement of yield and seed composition traits under drought stress conditions in soybean (Funded by: ICARNASF).
2. Phenotyping of pulses for enhanced tolerance to drought and heat (Funded by ICAR-NICRA).
3. Climate smart management practices . (Funded by: IRRI).
4. Conservation agriculture for enhancing resource-use efficiency, environmental quality and productivity of sugarcane cropping system (Funded by: CA Platform ICAR).
5. Establishment of model herbal garden for medicinal and aromatic plants (Funded by NMPB, New Delhi).
6. Development of Nano-based delivery system to mitigates arsenic pollution, ammonia and

temperature stress on growth and immune related gene expression in fish (Funded Under LBS Award).

7. Studies on N-(n-butyl) Thiophosphoric Triamide (NBPT) as a Urease Inhibitor for Improving Nitrogen Use Efficiency in major cropping systems in India.

TRAININGS ATTENDED

Dr Aliza Pradhan

- ICAR sponsored short course on "Advances in application of phenomics tools for assessment of abiotic stress responses of crop plants" organized by ICAR-NIASM, Baramati, 28 February- 9 March, 2022.

Dr HM Halli

- Training on 'Analysis of Experimental Data' organized by ICAR-NAARM, Hyderabad on 17-22nd January, 2022 (online mode).

Dr PS Khapte

- ICAR sponsored short course on "Advances in application of phenomics tools for assessment of abiotic stress responses of crop plants" organized by ICAR-NIASM, Baramati, 28 Feb - 9 March, 2022.
- Online Training Workshop on "Data Visualization Using R" Organized by ICAR-NAARM, Hyderabad. ICAR-NAARM, Hyderabad, 09-11 March, 2022.

Mr Sunil Potekar

- Online Training Programme on "Analysis of Experimental Data" organized by ICAR-NAARM, Hyderabad during 17-22 January, 2022.
- Online Training Workshop on "Data Visualization Using R" Organized by ICAR-NAARM, Hyderabad during 09 - 11 March, 2022.

PUBLICATIONS

Research Papers

- Basavaraj PS, Gireesh C, Bharamappanavara M, Manoj CA, Lakshmi VG, Senguttuvel IP, Sundaram RM, Subbarao LV, Anantha MS (2022) Genetic analysis of introgression lines of Oryza rufipogon for improvement of low phosphorous tolerance in indica rice. Indian Journal of Genetics and Plant Breeding. 82 (2): 135-142.
- Bhendarkar MP, Gaikwad BB, Ramteke KK, Joshi HD, Ingole NA, Bhramane MP, Gupta N (2021) Anticipating the impact of the COVID-19 lockdowns on the Indian fisheries sector for technological and policy reforms. Current Science.121:752–757.
- Boraiah KM, Gowda HGR, Nagaraja MS, Byregowda M, Keerthi CM, Ramesh S, Basavaraj PS (2022) Breeding Potential of Crosses Derived from Parents Differing in Overall GCA Status for Productivity per se Traits and Powdery Mildew Disease Response in Blackgram [Vigna mungo (L.) Hepper]. Legume Research. LR-4835: 1-7.
- Chavan SB, Uthappa AR, Sridhar KB, Kakade VD (2022) Scientific techniques for Melia dubia-based agroforestry systems: an emerging indigenous tree species for wood-based industries in India. Current Science. 122 (12): 1451.
- Govindasamy V, George P, Ramesh SV, Sureshkumar P, Rane J, Minhas PS (2022) Characterization of root-endophyticactinobacteria from cactus (Opuntiaficus-indica) for plant growth promoting traits. Archives of Microbiology. 204 (2): 1-14.
- Gupta, A., Singh, R.K., Kumar, M., Sawant, C.P., Gaikwad, B.B. (2021) On-farm irrigation water management in India: Challenges and research gaps. Irrigation and Drainage, 71(1), 3–22.
- Jadhav SD, Shinde VN, Kakade VD (2022) Characterization of leaves and fruits of mango (Mangifera indica L.). The Pharma Innovation Journal. 11 (4): 411-416.
- Jinger D, Kumar R, Kakade VD, Dinesh D, Singh G, Pande VC, Bhatnagar PR, Rao BK, Vishwakarma AK, Kumar D, Singhal V (2022) Agroforestry for controlling soil erosion and enhancing system productivity in ravine lands of Western India under climate change scenario. Environmental Monitoring and Assessment. 194: 267.
- Keerthika A, Chavan SB (2022) Oxygen production potential of trees in India. Current Science. 122 (7): 850.
- Khapte PS, Kumar P, Wakchaure GC, Jangid KK, Colla G, Cardarelli M, Rane J (2022) Application of phenomics to elucidate the influence of rootstocks on drought response of tomato. Agronomy. 12 (7):1529.

- Kumar S, Sharma P, Satyapriya S, Govindasamy P, Singh M, Kumar S, Halli HM, Choudhary BB (2022) Economic impression of on-farm research for sustainable crop production, milk yield, and livelihood option in semi-arid region of central India. Agronomy Journal. (https://doi.org/10.1002/agj2.21062).
- Magar AP, Nandede BM, Chilur R, Gaikwad BB, Khadatkar A (2021) Optimization of growing media and pot size for vegetable seedlings grown in cylindrical paper pots using response surface methodology. Journal of Plant Nutrition. 1–10.
- Potdar RR, Mehta CR, Gite LP, Agrawal KN, Gaikwad BB and Shukla P (2021) Reach Envelopes for Indian Tractor Operators Based on Anthropometry with a Gender-Neutral Perspective. Journal of Agricultural Engineering. Vol 59(2):113-125.
- Pradhan A, Aher L, Hegde V, Jangid KK, Rane J (2022) Cooler canopy leverages sorghum adaptation to drought and heat stress. Scientific Reports. 12 (1): 1-11.
- Rajarajan K, Uthappa AR, Handa AK, Chavan SB, Vishnu R, Shrivastava A, Handa A, Rana M, Sahu S, Kumar N, Singh AK (2022) Genetic diversity and population structure of Leucaena leucocephala (Lam.) de Wit genotypes using molecular and morphological attributes. Genetic Resources and Crop Evolution. 69 (1): 71-83.
- Rane J, Singh AK, Tiwari M, Vara Prasad PV, Jagadish K (2022). Effective use of water in crop plants in dryland agriculture: Implications of reactive oxygen species and antioxidative system. Frontiers in Plant Science. 12: 778270.
- Singh A, Kaul RK, Khapte PS, Jadon KS, Rouphael Y, Basile B, P Kumar (2022) Root knot nematode presence and its integrated management in pomegranate orchards located in Indian arid areas. Horticulturae. 8: 160.
- Singh AK, Raina SK, Kumar M, Aher L, Ratnaparkhe MB, Rane J, Kachroo A (2022) Modulation of GmFAD3 expression alters abiotic stress responses in soybean. Plant Molecular Biology. 1-20.
- Sirohi C, Bangarwa KS, Dhillon RS, Chavan SB, Handa AK (2022) Productivity of wheat (Triticum aestivum L.) and soil fertility with poplar (Populus deltoides) agroforestry system in the semi-arid ecosystem of Haryana, India. Current Science. 122 (9): 1072.
- Sirohi C, Dhillon RS, Chavan SB, Handa AK, Balyan P, Bhardwaj KK, Kumari S, Ahlawat KS (2022) Development of poplar-based alley crop system for fodder production and soil improvements in semi-arid tropics. Agroforestry Systems. 96 (4): 731-745.
- Wasnik VK, Ghosh PK, Halli HM, Gupta G (2022) Effect of tillage and weed control measures on the yield and economic efficiency of maize under rainfed conditions of semi-arid region. Indian journal of weed science. 54 (1): 51-57.

Book Chapters

- Basavraj PS, Rane J, Boraiah KM, Madhusudan R, Drmbru S (2022) Millet Crops: Impact and Management of Abiotic Stresses. In: Pathak et al (Eds) Abiotic Stress Impacts and Management. ICAR-National Institute of Abiotic Stress Management, Baramati, Pune, India. pp 198-208. eISBN No. 978-81-949091-0-1.
- Basavraj PS, Ratnakumar P, Manikantha LN, Boraiah KM, Rane J (2022) Oilseed Crop: Impact and Management of Abiotic Stresses. In: Pathak et al (Eds) Abiotic Stress Impacts and Management. ICAR-National Institute of Abiotic Stress Management, Baramati, Pune, India. pp 163-197. eISBN No. 978-81-949091-0-1.
- Chavan SB, Uthappa AR, Kumar R, Kumar M, Chichaghare AR, Keerthika A, Kakade VD, Harisha CB, Nangare DD, Taware PB (2022) Agroforestry Systems: Impacts and Management of Abiotic Stresses. In: Pathak et al (Eds) Abiotic Stress Impacts and Management. ICAR-National Institute of Abiotic Stress Management, Baramati, Pune, India. pp 368-388. eISBN No. 978-81-949091-0-1.
- Goud BR, Raghavendra M, Prasad PS, Hatti V, Halli HM, Nayaka GV, Suresh G, Maheshwari KS, Adilakshmi G, Reddy GP, Rajpoot SK (2022) Sustainable Management and Restoration of the Fertility of Damaged Soils. Agriculture Issues and Policies. p.113.
- Gurumurthy S, Meena SK, Vysnavi RG, Basu PS, Kumar S, Mohanty PK, Boraiah, Rane J (2022) Pulse Crop: Impact and Management of Abiotic Stresses. In: Pathak et al (Eds) Abiotic Stress Impacts and Management. ICAR-National Institute of Abiotic Stress Management, Baramati, Pune, India. Pp 151-162.eISBN No. 978-81-949091-0-1.
- Halli HM, Hatti V, Gupta G, Raghavendra M, Meena MP, Gouda R (2022) Scientific approaches for water resources management in developing countries. In Urban Water Crisis and Management by Elsevier publication Directions

in Water Scarcity Research, Elsevier Inc. Volume 6. pp 129-147.
- Harisha CB, Shakarprasad KS, Arpitha HS, Narayanpur BV, Chavan SB, Paritosh Kumar P, Karde RY (2022) Medicinal and Aromatic Plants: Impacts and Management of Abiotic Stresses. In: Pathak et al (Eds) Abiotic Stress Impacts and Management. ICAR-National Institute of Abiotic Stress Management, Baramati, Pune, India. pp 339-367. eISBN No. 978-81-949091-0-1.
- Kakade VD, Morade A, Nangare DD, Kumar S, Chavan SB, Taware PB, Potekar S, Jadhav S (2022) Impact and Management of Abiotic Stresses in Fruit Crops. In Impact and Management of Abiotic Stresses in Fruit Crops. pp 227-260.
- Khapte PS, Kumar P, Wakchaure GC and Rane J (2022) Vegetable Crops: Impact and Management of Abiotic Stresses In: Pathak et al (Eds) Abiotic Stress Impacts and Management. ICAR-National Institute of Abiotic Stress Management, Baramati, Pune, India. pp 209-226. eISBN No. 978-81-949091-0-1.
- Kochewad SA, Kurade NP, Gaur GK, Pawar SS, Gopalkrishnan B, Nirmale AV (2022) Abiotic Stress Management in Dairy Animals (Chapter 21). Book Title: Abiotic Stresses in Agriculture: Impacts and Management. Editors: Pathak H, et. al. (EDS). ISBN: 978-81-949091-0-1. Publisher: ICAR-National Institute of Abiotic Stress Management. pp: 141-439.
- Kumar M, Taria S, Kumar S, Basavraj PS, Rane J (2022) Water stresses in agriculture. In: Pathak et al (Eds) Abiotic Stress Impacts and Management. ICAR-National Institute of Abiotic Stress Management, Baramati, Pune, India. pp 15-26. eISBN No. 978-81-949091-0-1.
- Kurade NP, Pawar SS, Kochewad SA, Nirmale AV, Sahoo A (2022) Abiotic Stresses in Other Livestock: Impacts and Management (Chapter 23). Book Title: Abiotic Stresses in Agriculture: Impacts and Management. Editors: Pathak H, et. al. (EDS). ISBN: 978-81-949091-0-1. Publisher: ICAR-National Institute of Abiotic Stress Management. pp: 455-476.
- Kurade NP, Gaikwad BB, Singh, RN, Pawar SS, Bhendarkar MP (2022). Atmospheric Stresses in Agriculture. In: Abiotic Stresses in Agriculture: Impact and Management, eISBN: 978-81-949091-0-1, pp 49-75).
- Kure RK, Gaikwad BB, Nangare DD (2022). Extension strategies for Abiotic stress management in agriculture. In: Pathak et al (Eds) Abiotic Stress Impacts and Management. ICAR-National Institute of Abiotic Stress Management, Baramati, Pune, India. pp 54-573. eISBN No. 978-81-949091-0-1.
- Paramesha V, Rajanna GA, Kumar P, Sannagoudar MS, Halli HM (2022) Drip Fertigation for Enhancing Crop Yield, Nutrient Uptake, Nutrient, and Water Use Efficiency. Sustainable Agriculture Systems and Technologies. Pp 267-278.
- Pathak H, Kakade VD (2022) Abiotic Stresses in Agriculture: Impacts and Management. In: Pathak et al (Eds) Abiotic Stress Impacts and Management. ICAR-National Institute of Abiotic Stress Management, Baramati, Pune, India. pp 1-14. eISBN No. 978-81-949091-0-1.
- Pawar SS, Rokade JJ, Kochwad SA, Nirmale AV, Kurade NP. (2022) Abiotic Stresses in Poultry: Impacts and Management (Chapter 24). Book Title: Abiotic Stresses in Agriculture: Impacts and Management. Editors: Pathak H, et. al. (EDS). ISBN: 978-81-949091-0-1. Publisher: ICAR-National Institute of Abiotic Stress Management. pp: 477-498.
- Pradhan A, Rane J, Singh RK, Wakchaure GC (2022) Abiotic stresses in quinoa: Impacts and management In: Pathak et al (Eds) Abiotic Stress Impacts and Management. ICAR-National Institute of Abiotic Stress Management, Baramati, Pune, India. pp 389-400.eISBN No. 978-81-949091-0-1.
- Rajkumar VB, Sunitha ND, Gopalkrishnan B, Pawar SS, Kurade NP, Salunkhe VN (2022) (Chapter 27). Abiotic Stresses and Insects: Impacts and Management. Book Title: Abiotic Stresses in Agriculture: Impacts and Management. Editors: Pathak H, et. al. (EDS). ISBN: 978-81-949091-0-1. Publisher: ICAR-National Institute of Abiotic Stress Management. pp: 526-536.
- Sahoo A, Nirmale AV, Kurade NP, Pawar SS (2022) Impact and management of abiotic stress in small ruminants (Chapter 22). Book Title: Abiotic Stresses in Agriculture: Impacts and Management. Editors: Pathak H, et. al. (EDS). ISBN: 978-81-949091-0-1. Publisher: ICAR-National Institute of Abiotic Stress Management. pp: 440-454.
- Singh AK, Gurumurthy S, Rane J, Mamrutha HM, Singh GP (2022) Wheat: Impact and Management of Abiotic Stresses. In: Pathak et al (Eds) Abiotic Stress Impacts and Management. ICAR-National Institute of Abiotic Stress Management, Baramati, Pune, India. pp 97-115. eISBN No. 978-81-94991-0-1.

- Taria S, Kumar M, Alam B, Kumar S, Kumar S, Roy S, Rane J (2022) Abiotic stress and plant response: Adaptive mechanisms of plants against multiple stresses. In Mitigation of Plant Abiotic Stress by Microorganisms, Academic Press. pp 1-17.
- Tewari S, Bhatt P, Negi H, Dubey A, Chavan SB, Chichaghare A, Kaushal R (2022) Land Use and Biodiversity Conservation Through Agroforestry. In Augmenting Crop Productivity in Stress Environment, Springer, Singapore. pp 367-390.
- Wakchaure GC, Kumar S, Khapte PS, More N, Pradhan A, Biswas AK, Rane J (2022) Abiotic Stresses in Sugarcane: Impacts and Management. In: Pathak et al (Eds) Abiotic Stress Impacts and Management. ICAR-National Institute of Abiotic Stress Management, Baramati, Pune, India. pp 272-299. eISBN No. 978-81-949091-0-1.

Popular Article

- Chavan SB, Kakade VD, Deshmukh H (2022) वनशेतीमध्ये शिसव लागवडीला संधी. Agrowon 21 January 2022 pp 12.
- Chavan SB, Uthappa AR, Keerthika A (2022) Can agroforestry help achieve sustainable developmental goals? Down to Earth on 10 May 2022.
- Chavan SB, Uthappa AR, Keerthika A (2022) NTFP: A Tribal ATM in World Forestry Congress, Korea.
- Harisha CB, Boraiah KM, Basavraj PS and Narayanpur VB (2022) Chia - The Less Known Plant of Omega-3 Fatty Acid". Acta Scientific Agriculture 6(3): 08-10.
- Jadhav SD, Nangare DD, Kakade VD (2022) Karonda: Under-Exploited Fruit Crop for Dry Land Condition. Just Agriculture. 2 (9), May 2022.
- Keerthika A, Parthiban KT, Chavan SB (2022) Harnessing the unrealized potential of multifunctional agroforestry an ecosystem service station- Blog in World Forestry Congress under #WorldForestVoices, Korea.
- Pawar SS, Malakar D, Kurade NP, Nirmale AV (2022). Gene Silencing: An Important tool in the biological sciences. Agri Journal World. Vol 2 (1): 1-4.
- Pawar SS, Nirmale AV, Bhendarkar MP, Gaikwad BB, Kurade NP (2021) मुर्गियों में गर्मी का तनाव: उपाय एवं प्रबंधन. Sufalam. Issue 3: 33-36.
- Salavi P, Chavan SB, Berde G (2022) व्यवस्थापन सोनचाफा लागवडीचे. Agrowon published on 19 February 2022 pp 12.

PERSONALIA

Awards / Recognitions

1. Dr Himanshu Pathak, Director, ICAR-NIASM, Baramati ranked at No. 365 in the world and No. 5 in India in the field of Plant Science and Agronomy by the Research.com (https://research.com/scientists-rankings/plant-science-and-agronomy).
2. Dr Aliza Pradhan received 'Young Women Scientist-2021' award in the field of Agronomy by GKV Society, Agra during International conference on "Recent advances for managing sustainable soil health and crop production" during 18-20 February, 2022.
3. Dr Chavan SB received 'Best Scientist Award' on Institutes 14th Foundation Day.
4. Dr Chavan SB received 'Best Young Scientist Award' by Professionals of Agriculture & Technology Society, Sangli.
5. Dr Chavan SB received International Travel Support grant from SERB India to attend 5th World Agroforestry Congress in Canada.
6. Dr Chavan SB recognized as "Blog Competition Winner" by Korea Forest Service and FAO at XV World Forestry Congress 2-6th the 2022 Seoul, Republic of Korea.
7. Dr GC Wakchaure received 'Indian Achievers Award 2021-22' in Recognition of Outstanding Professional Achievement & Contribution in Nation Building, Indian Achievers' Forum & CSR Times, Delhi.
8. Dr GC Wakchaure received the 'Best Scientist Award' on Institutes 14th Foundation Day.
9. Gurumurthy S, Soren KR, Husain K, Rane J, Pathak H received Best poster award at National Conference on climate resilient and sustainable development of horticulture during 28-31May, 2022 at CSAUA&T, Kanpur, Uttar Pradesh.
10. Harisha CB received Best Oral presentation award at 2nd Indian Horticulture Summit held at NAU, Navsari during 27-29 April 2022.
11. Harisha CB received Best poster award at 2nd Indian Horticulture Summit held at NAU, Navsari during 27-29 April 2022.
12. Mr Lalitkumar Aher received 'Best Performance Award 2022' on Institutes 14th Foundation Day.
13. Salunkhe VN, Chavan SB, Lonkar SG, Bhagat YS, Kakade VD received 'Best Oral Presentation' award at 8th International conference of Indian Phytopathological Society (IPSCONF2022) during 23rd-26th March, 2022 held at SKNAU, Jobner-Jaipur, Rajasthan, India.

Promotions

Dr GC Wakchaure promoted to Senior Scientist (RGP 9000) w.e.f. 10.02.2021.

Dr BB Gaikwad promoted to Senior Scientist (RGP 8000) w.e.f. 17.04.2019.

Dr SA Kochewad promoted to Senior Scientist (RGP 8000) w.e.f. 23.06.2019.

Dr VN Salunkhe promoted to Senior Scientist (RGP 8000) w.e.f. 27.04.2020.

Dr Mahesh Kumar promoted to Senior Scientist (RGP 8000) w.e.f. 27.04.2020.

Dr Satish Kumar promoted to Senior Scientist (RGP 8000) w.e.f. 15.09.2021.

Dr Gopalkrishnan B promoted to Senior Scale (RGP 7000) w.e.f. 01.01.2019.

Dr Paritosh Kumar promoted to Senior Scale (RGP 7000) w.e.f. 01.01.2020.

Mr Rajkumar promoted to Senior Scale (RGP 7000) w.e.f. 01.01.2021.

Mr MP Bhendarkar promoted to Senior Scale (RGP 7000) w.e.f. 01.01.2021.

Mr Lalitkumar Aher promoted to Technical Officer w.e.f. 14.07.2021.

Mr Sunil Potekar promoted to Technical Officer w.e.f. 28.07.2021

Mr Patwaru Chahande promoted to Technical Officer w.e.f. 16.09.2021.

Transfers

Dr Satish Kumar, Senior Scientist, transferred to ICAR-DOGR, Pune w.e.f. 30.04.2022.

Mr Anil Kumar Sidharth, F&AO transferred to ICAR-IARI, New Delhi w.e.f. 02.07.2022.

New Joinings

Mr Charles Ekka, CAO, joined ICAR-NIASM, Baramati w.e.f. 21.05.2022 after transfer from ICAR-CRIDA, Hyderabad