



NIASM – A Decade of Service (2009 – 2019)

Ajay Kumar Singh
Mahesh Kumar
Neeraj Kumar
Jagadish Rane
NP Singh
H Pathak



भाकृअनुप - राष्ट्रीय अजैविक स्ट्रेस प्रबंधन संस्थान
ICAR-NATIONAL INSTITUTE OF ABIOTIC STRESS MANAGEMENT
(Indian Council of Agricultural Research)





NIASM - A Decade of Service (2009 - 2019)

Ajay Kumar Singh
Mahesh Kumar
Neeraj Kumar
Jagadish Rane
NP Singh
H Pathak



राअस्ट्रैप्रसं
NIASM

भाकृअनुप-राष्ट्रीय अजैविक स्ट्रेस प्रबंधन संस्थान

ICAR-NATIONAL INSTITUTE OF ABIOTIC STRESS MANAGEMENT

(Indian Council of Agricultural Research)

बारामती, पुणे -413 115, महाराष्ट्र, भारत

Baramati, Pune 413 115, Maharashtra, India

NIASM - A Decade of Service (2009-2019)

Citation

Ajay Kumar Singh, Mahesh Kumar, Neeraj Kumar, Jagadish Rane, Narendra Pratap Singh and Himanshu Pathak (2020) NIASM-A Decade of Service. ICAR-National Institute of Abiotic Stress Management. Baramati, Pune, Maharashtra, pp 65.

All Right Reserved

@ 2020, ICAR-National Institute of Abiotic Stress Management, Baramati, Pune, Maharashtra

ISBN No.: 978-81-949091-5-6

Published by

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

Design & Art

Mr. Pravin More, NIASM, Baramati
Mr. Sunil Sinha, NRRI, Cuttack

Disclaimer

ICAR-National Institute of Abiotic Stress Management, Baramati, Pune, Maharashtra is not liable for any loss arising due to improper interpretation of the scientific information provided in the bulletin.



त्रिलोचन महापात्र, पीएच.डी.

सचिव, एवं महानिदेशक

TRILOCHAN MOHAPATRA, Ph.D.
SECRETARY & DIRECTOR GENERAL

भारत सरकार
कृषि अनुसंधान और शिक्षा विभाग एवं
भारतीय कृषि अनुसंधान परिषद
कृषि एवं किसान कल्याण मंत्रालय, कृषि भवन, नई दिल्ली 110 001

GOVERNMENT OF INDIA
DEPARTMENT OF AGRICULTURAL RESEARCH & EDUCATION
AND
INDIAN COUNCIL OF AGRICULTURAL RESEARCH
MINISTRY OF AGRICULTURE AND FARMERS WELFARE
KRISHI BHAVAN, NEW DELHI 110 001
Tel.: 23382629; 23386711 Fax: 91-11-23384773
E-mail: dg.icar@nic.in

FOREWORD

Abiotic stresses such as drought, temperature extreme, flood, salinity, acidity, mineral toxicity and nutrient deficiency have emerged as major challenges for Indian agriculture threatening food and nutrition security. The anticipated increase in frequency of extreme weather events due to changing climate pose serious threats to sustainable production of crops, livestock, fish and poultry. ICAR-National Institute of Abiotic Stress Management (NIASM) was established at Malegaon, Baramati in February 21, 2009 as one of the national institutes to carry out basic and strategic research for management of various abiotic stresses affecting sustainability of national food production systems. The mission of the Institute is to manage abiotic stresses for sustainable agriculture. The Institute's activities focus on abiotic stress management practices to enhance farmers' income in different abiotic stress environments. The Institute has completed ten years of its service to the nation. In the last ten years this Institute has developed the state-of-the-art research facilities including plant phenomics, hi-tech greenhouses, well-equipped laboratories to conduct advanced basic and strategic research, modern research farm, livestock and fishery research farm. Research programmes of the Institute are designed to promote multi-disciplinary team of scientists using frontier technologies to reduce adverse impacts of abiotic stress in agriculture.

In a short-time, the Institute has developed various technologies to address the issues of water scarcity, management of water and edaphic stress in orchards, pollution due to burning of sugarcane trash. The Institute has demonstrated the innovating planting technologies for establishment of various orchards under limited soil moisture in degraded land. These technologies have been demonstrated at the institute and farmers field. Institute has developed technology for transforming uncultivable rocky basaltic terrain into productive land. The Institute has standardized the cultural practices for dragon fruit cultivation in stressed semi-arid regions. The technologies could be very useful to increase the income of farmers. The Institute has come out with admirable research publications in reputed journals.

Institute conducts trainings, workshops and winter schools on abiotic stress management practices to enhance farmer's income in agro-ecosystems challenged by adverse environmental factors. It is going to start M.Sc. programme from the current academic session in collaboration with Indian Agricultural Research Institute, New Delhi and other universities.

This bulletin on '**NIASM-A Decade of Service**' provides a glimpse of research and academic facilities available in the Institute, various research activities carried out, new knowledge and technologies generated, capacity building programmes conducted and the future plans of the Institute. I compliment the authors for bringing out this publication highlighting the achievements of ICAR-NIASM during ten year of its existence. It will be very useful for researchers, students and farmers to address the atmospheric, water and soil-related stresses for climate resilient, sustainable agriculture. It will serve as a ready-reference for information on research and teaching activities and potential collaborations in crop science, horticultural science, natural resource management, livestock, fisheries, veterinary and policy research at NIASM.



(T. Mohapatra)

Date: 14th December 2020
Place: New Delhi-110 001

Preface


The ICAR-National Institute of Abiotic Stress Management (NIASM), Baramati is the unique research institute for basic and strategic research to assess the mechanisms and develop robust tools and technologies for managing abiotic stresses in agricultural systems. The activities of this institute focus on abiotic stress management practices to enhance farmer's income in agro-ecosystems challenged by atmospheric, drought and edaphic stresses. The Institute's research programs are structured to encourage multi-disciplinary team of scientists using frontier technologies to minimize the adverse impacts of abiotic stresses in agriculture. The Institute has state-of-the-art laboratory facilities, high-tech greenhouses, phenomics facility, experimental research farm, animals and fisheries experimental research units. Though the initial efforts of the institute were devoted to development of these facilities, some technologies have emerged to manage abiotic stresses and they could be very beneficial for enhancing farmer's income.

This bulletin on NIASM-A Decade of Service provides the detailed information about infrastructure developed for research and academic activities, new knowledge and technologies developed by the institute as well as publications in peer reviewed journals and capacity development programme carried out during the one decade of its existence. The bulletin will guide the researchers, students, policy makers and farmers as a ready reference for information on research and teaching activities and potential collaborations in crop science, horticultural science, natural resource management, livestock, fisheries, veterinary and policy research.

I sincerely acknowledge the invaluable contributions rendered by current and former scientists, researchers, technical, administrative as well as contractual staff to develop the institute. Acknowledgements are due to Indian Council of Agricultural Research, New Delhi for providing all support and encouraging us. I extend my sincere thanks to Dr. Trilochan Mohapatra, Secretary (DARE) & Director General (ICAR); Shri Sanjay Kumar Singh, Additional Secretary (DARE) & Secretary (ICAR); Shri Bimbadhar Pradhan, Special Secretary & Financial Advisor (DARE/ICAR); Dr. Suresh Kumar Chaudhari, DDG (NRM); Dr. S. Bhaskar, ADG (AAF&CC) and Dr. Adul Islam, ADG (S & WM) for their continued support to ICAR-NIASM. I appreciate the efforts made by the authors in bringing out this publication. We are thankful to the members of the publication committee of NIASM for their help and support and Mr. Pravin More, NIASM, Baramati and Mr. Sunil Sinha, NRRI, Cuttack for type-setting, formatting and developing the outline, cover page of the publication.

I hope that the information provided in this publication will be very useful for researchers, policy makers, students and the farmers.

Date: December 14, 2020
Place: Baramati, Pune


(Himanshu Pathak)
Director

Contents

1.	Introduction	1
2.	Infrastructure for Research and Academics	3
	<ul style="list-style-type: none">• Office-cum Administrative building• Auditorium• Conference rooms• School buildings• Staff quarters• Guest house and hostels• Library• Staff Canteen• Medical facility	
3.	State-of-the-Art Research Facilities	8
	<ul style="list-style-type: none">• Genetic engineering, Molecular biology and Microbiology laboratories• Plant phenomics facility• Greenhouse facility	
4.	Research Farm	11
	<ul style="list-style-type: none">• North and South block research farm• Model herbal garden• Livestock research farm• Fisheries research farm	
5.	Technology Developed by the Institute	14
	<ul style="list-style-type: none">• Transforming barren rocky basaltic terrain into the cultivation of arable crops.• Innovative orchard establishment methods for obviating drought and edaphic stresses of orchards grown in shallow basaltic soils of semi-arid region.• Dragon fruit: Wonder crop for rocky barren lands and water-scarce areas.• SORF: A multipurpose machine for ratoon sugarcane.• Plant bioregulators for enhancing productivity and quality of major crops under water-scarce regions.• Nanostructured material for stress alleviation in aquaculture.• Development of a microbial-derived polymeric product for gel formation, microbial colonization and metal binding.• Deficiency irrigation as on-farm strategy for improving water productivity of horticulture crop grown in limited water in shallow basaltic terrain.• Mixed silage of sugarcane tops for sustaining milk production during scarcity periods in drought prone areas.	
6.	Publications	24
7.	Trainings/Workshops conducted	35
8.	Outreach Activities of the Institute	48
	<ul style="list-style-type: none">• TSP (Tribal Sub-Plan)• MGMG (Mera Gaon Mera Gaurav)	

Introduction

Agriculture is the backbone of Indian economy. It is also the key to achieve the Sustainable Development Goals. The country has made enormous progress in agriculture in the last few decades. With a net sown area of 140 million ha, the food grain production in 2019-20 is over 296 million tonnes, with equally significant increased production levels in horticultural crops, milk, meat, fish and eggs. These have enabled not only self-sufficiency of food in the country, but also a sizeable export of agri-commodities. With the population expected to be over 1.6 billion by 2050, annual food demand is likely to rise to 400 million tonnes, requiring a minimum of 4% annual growth in agriculture. However, it faces numerous constraints and vagaries originating from soil, water and atmosphere. It is challenging to achieve the task when we realize the fact that natural resources are limited, harm to environment to be avoided and importantly it is necessary to cope with the changing climate. Abiotic stresses like drought, flood, extreme temperature, salinity, acidity, mineral toxicity and nutrient deficiency have emerged as major challenges for Indian agriculture. The anticipated increase in frequency of extreme weather events due to changing climate poses serious threats to sustainable production of crops, livestock, fish and poultry. The ‘new agriculture’ should be more holistic, with regard to productivity, profitability and sustainability, with a continuum of agriculture-food-nutrition-health-environment-employment.

ICAR-National Institute of Abiotic Stress Management (NIASM) was established in February 21, 2009 as one of the national institutes under Indian Council of Agricultural Research to carry out basic and strategic research for management of various abiotic stresses affecting sustainability of national food production systems. Establishment of National Institute of Abiotic Stress Management is very important to scientific knowledge generation and utilisation for management of agriculture during drought, temperature extremes, floods, salinity, acidity, mineral toxicity and nutrient deficiency in the present form or in the larger versions anticipated due to changing climate. The Institute has the mission of managing abiotic stresses in multi-stressed agro-ecosystems for sustainable agriculture. The Institute conducts basic and strategic research to manage abiotic stresses in crops, livestock and fisheries; provides a repository of information on abiotic and biotic stresses, adaptation and mitigation strategies and policies and serves as a Center of Academic Excellence in managing multiple stresses in agriculture. There is uniqueness embedded in the conception of this institute with all the sectors of agriculture including grain crops, horticulture, livestock and fisheries in the mandate for management of abiotic stresses which do not discriminate agricultural commodities. This very concept will make a strong base for holistic approaches to be developed to reduce adverse impact of abiotic stresses in agriculture and contribute to the sustainability of agriculture in the country. The Institute is well-equipped with state-of-the-art facilities including plant and soil response monitoring systems extensively in addition to the academic logistics. The Institute is focussing on diverse mitigation and adaptation options for management of high temperature, drought, waterlogging, salinity in crops and related issues in livestock and aquaculture. In a short-time, the Institute has developed various technologies to address the issues of water scarcity, management of water and edaphic stress in orchards, pollution due to burning of trash. The institute has demonstrated the innovating planting technologies for establishment of various orchards under limited soil moisture in degraded land. These technologies have been demonstrated at the institute and farmers field. Institute has developed technology for transforming uncultivable rocky basaltic terrain into productive land. Dragon fruit has been identified as a wonder crop suitable to adopt and grow in low rainfall zone having barren land. The Institute has standardized the cultural practices for dragon fruit cultivation in stressed semi-arid regions. Contribution of

the institute in demonstrating the impact of modern technologies in TSP farmers and improving their livelihood is commendable. The Institute is going to initiate its academic programmes shortly to impart knowledge to young researchers.

The objectives of the bulletin are to provide information about infrastructure developed for research and academic activities, new knowledge and technologies developed by the institute as well as publications brought out and capacity development programme carried out during the one decade of its existence.

Mission

Managing abiotic stresses for sustainable agriculture.

Mandate

- Basic and strategic research to manage abiotic stresses in crops, livestock and fisheries.
- Repository of information on abiotic and biotic stresses adaptation and mitigation strategies and policies.
- Building sustainable agriculture in multi-stressed agro-ecosystems.
- Serve as Center of Academic Excellence in managing multiple stresses in agriculture.

History

The Moily Oversight Committee on OBC Reservations recommended the establishment of a dedicated research institute of Deemed-to-be-University status on Abiotic Stress Management. In XI plan, the proposal by the Ministry of Agriculture was approved by the Union Cabinet to establish 'National Institute of Abiotic Stress Management' with a legal status of Deemed-to-be-University under the Indian Council of Agricultural Research at Gat No. 35, Malegaon Khurd, Baramati, Pune, Maharashtra. National Institute of Abiotic Stress Management (NIASM) was established on February 21, 2009 as one of the national institutes under Indian Council of Agricultural Research (ICAR) to carry out basic and strategic research for management of various abiotic stresses in agricultural commodities viz., crop plants, livestock, and fish and poultry birds.

ICAR-National Institute of Abiotic Stress Management is working for management of abiotic stresses affecting the sustainability for national food production systems. It deals with stresses due to atmosphere, water and soil, which are major causes for agricultural losses in crop, animal and fisheries sectors. Abiotic stresses are natural, borne in the atmosphere (temperature, heat, cold, chilling, frost, radiation, UV ionization, air pollutants, CO₂ and other greenhouse gases), water (drought, flooding, hypoxia, sea water inundation), soil (salinity, alkalinity, sodicity, acidity, water logging, poor water quality), chemicals (mineral deficiency/excess, pollutant, heavy metal/pesticides/ gaseous toxin), mechanicals (aerosol, wind, soil shifting). They occur in the multiples and affect all the sectors of agriculture, crop, animal and fisheries. Since, these stresses are predicted to amplify due to climate change scenario, the primary task for the institute is to evolve strategies involving mitigation and adaptation techniques through advance in frontier science research. It is essential to consolidate by adopting frontier molecular, biotechnological, nano-technological and other tools to develop genetically stable crop, livestock, and fisheries on the strategic platform of resource management. The NIASM is structured to enhance the capacity of scientists and policy makers mainly by imparting knowledge and providing state of the art facilities for multidisciplinary and multi-commodity research. Multi-disciplinary teams have been formed to work together for prompt results in the emerging field of research. The institute has four

schools: 1) Atmospheric Stress Management School, 2) Water Stress Management School, 3) Soil Stress Management School and 4) Social Science and Policy Support.

Having placed in an area surrounded by abiotic stress prone agro-ecologies, ICAR-NIASM shoulders unique responsibility of providing viable management solutions for sustainable and profitable agriculture for the farmers. Majority of the challenges of abiotic stresses are due to sub or supra optimal levels of water leading to drought or flood, salts leading to salinity or alkalinity, temperatures leading to heat or cold, soil minerals that can create deficiency or toxicity in addition to devastating events such as hail storm. Management of these stresses demands a deep insight into the causal factor and mechanisms of tolerance or survival of agricultural commodities such as crops, livestock and fish which all contribute to farmers' income and livelihood. Hence, NIASM is engaged in basic and strategic research to holistically address atmospheric, drought and edaphic stresses, which are the major causes of substantial losses for farmers and Indian agriculture. The advantage of studying at NIASM lies in its strategic location featured by agro-ecological challenges around the institutes, which needs to be created artificially at other institutes in the vicinity of mega cities. These harsh and real-time situations, which farmers routinely face, offer opportunities for post-graduate students to pick up research topics that can have long term impacts. Students can pick up translatable knowledge in agriculture and basic sciences for making such impacts. Located two hours away by road from Pune, the cultural city of Maharashtra and being at Malegaon, a model and modern village with all urban facilities in the vicinity at Baramati, the institute offers a serene ambiance for academic and research activities.

Infrastructure for Research and Academics

Office-cum Administrative Building

Office-cum administrative building, a unique architectural masterpiece, is fully furnished with centralized air-conditioning systems, and a centrally placed open-air amphi-theater equipped with a public address system. The building premises are equipped with fire detection and alarm system.



Auditorium

The auditorium, named as “Sardar Vallabhbhai Patel Auditorium”, has a capacity of 230 seats and is well equipped with an audio-visual facility, centralized air condition facility and a spacious stage, which are used to conduct various events at the institute.



Conference Rooms

In addition to auditorium, the institute has four conference rooms equipped with audio-visual systems, which can allow parallel sessions for conferences and training.



School Buildings

Two school buildings namely the School of Water Stress Management (WSM) and School of Soil Stress Management (SSSM) have been constructed, furnished and occupied. Each school building is having a reception corridor, two laboratories with a store room, one room for Head of the Division, 12 rooms for scientific staff and two rooms for technical staff, one class room, one reading room, a store room, pantry and record room.



School of Soil Stress Management



School of Water Stress Management

Staff Quarters

Type VII quarter of 298 square meter area has been constructed for Director Residence. Beside this, Type-IV quarters (6 Nos.) for NIASM staffs have also been built in the institute campus.

Residential complex of Type VI (4 Nos.), Type V (6 Nos.), Type IV (8 Nos.) and Type III (8 Nos.) have been constructed at MIDC, Baramati. The area is having peripheral plantation, garden, road, street lights and an electric substation.



Director residence



Staff quarter, on-campus



Type III & IV Quarter, MIDC, Baramati



Type V Quarter, MIDC, Baramati



Type VI Quarter, MIDC, Baramati

Guest House

The Nira Guest House is furnished with furniture in each room and linen material and has been made ready to accommodate 20 guests. The guest house has a well-furnished kitchen and dining halls.



Hostels

The hostel building has 72 rooms in two blocks with an attached bathroom in each room with provision of solar water heater. The dining block of these hostels is equipped with modular commercial kitchen with a seating capacity of around 100 persons.



Library

NIASM library has a good collection of books with areas related to agriculture, animal husbandry and basic science subjects as per the mandate of the Institute. Scientists, technical personnel, research associates, students and trainees are regular users of the library. Library maintained its designated services and activities of acquisition of books, exchange of literature, circulation, reference services and documentation. Present library acquisitions have more than 2500 books in addition to other documents like newsletters of NAAS/ ICAR institutes and other open source articles and documents. Library regularly receives more than 100 publications including annual reports as gratis from various organizations. ICAR-NIASM Library is one of the members of the ICAR-CeRA Consortium. Hence, all scientists and technical personnel have facilities of accessing on-line journals. Library transactions are being implemented online to cater the needs of the institute's staff. Institute has access to e-books from various reputed publishers along with 17 e-book series, India Agristat database through CeRA.



Library



Reading Room

Staff Canteen

The Canteen is located in the administrative building of ICAR-NIASM. This has adequate ventilation as well as a central air-conditioning system.



Medical Facility

Medical services of the Allopathic and Ayurvedic doctors are available on a part-time basis during office hours in the institute campus. Baramati city has very good medical facilities.



State-of-the-Art Research Facilities

Genetic Engineering, Molecular Biology and Microbiology Laboratories

Institute has a state of-the-art laboratory at each of the three schools which have been strengthened with sophisticated equipment's such as Inductively Coupled Plasma Mass Spectrometry (ICP-MS), Stereo zoom Microscope, Hyperspectral Spectroradiometer, Atomic Absorption Spectrophotometer (AAS), Portable Photosynthesis System, Microwave Digestion System, Real time Chlorophyll Fluorescence Imaging System, Infrared Thermal Imaging System, CO₂ incubator, GC, HPLC, BIOLOG, Nanodrop, Root scanner, Automatic Nitrogen analyser, Fluorescent microscope and light microscope, etc.

Plant Genetic Engineering and Molecular Biology (PGEN & Mol. Bio) Laboratory has been developed to carry out basic and strategic research to address plants response to various abiotic stresses. The PGEN and Molecular Biology laboratory has facilities for genomics, proteomics and for generating transgenic plants. The laboratory is well equipped with PCR cycler, Real-time PCR, Lyophilizer, Ultra-high-speed centrifuge, Bio-safety cabinets, Chemiluminescence imaging system, Multimode reader for DNA, RNA and protein quantification. The ROS generated due to various kinds of stresses can also be quantified and measured by multimode reader. Plant Tissue Culture (PTC) facility has been established and PTC facility having automated horizontal sterilizers, small growth chambers, walk-in growth chambers for growing and maintaining transgenic/Genetically modified/cisgenic/VIGS and RNAi silenced plants.



Plant genetic engineering & molecular biology laboratory



Walk-in plant growth chamber



Plant growth chamber



Plant tissue culture facility



Trait discovery laboratory



Microbiology laboratory

Plant Phenomics Facility

The plant phenomics facility established under NICRA program is now fully functional. The Plant Phenomics facility with a capacity to house 225 pots is equipped with three imaging sensors viz., Infra-Red (IR), Visible (VIS) and Near-Infra Red (NIR). The facility is also equipped with automated weighing and precise watering stations. The system utilizes a conveyor belt system to move the plants with in the facility to and fro from growth chambers to the imaging cabinet. The entire facility is computer operated through Lemna Control Software.



Plant phenomics facility



Imaging chamber



Plants growing in phenomics facility



Inauguration of plant phenomics facility

Greenhouse Facility

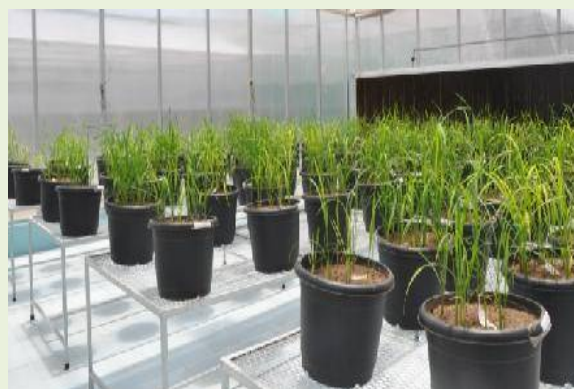
There are four Hi-tech greenhouses with area of 240 m². Each Greenhouse is having three chambers of 10 m x 8 m. Greenhouses are equipped with cooling pad and axial exhaust fan system with a platform for growing plants. These greenhouses have provision for controlling temperature, photoperiod and humidity.



Hi-tech Greenhouse Facility



Soybean plants growing in Greenhouse



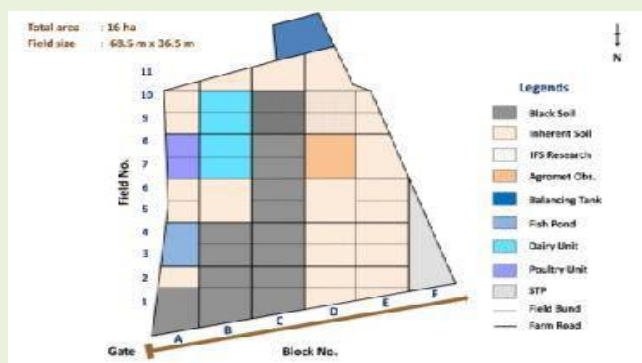
Rice plants growing in Greenhouse

Research Farm

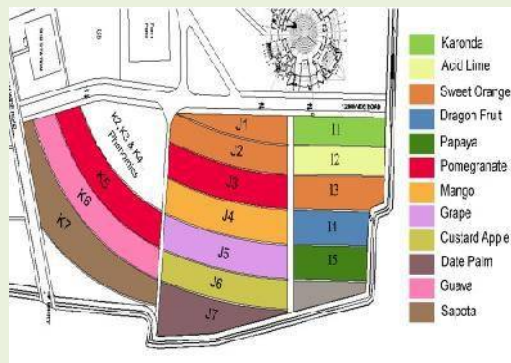
South and North Block Research Farm

The south side farm (16 ha) is divided into six blocks, which have been further sub-divided into 37 rectangular/trapezoidal plots including agro-met observatory. Experiments related to atmospheric, edaphic and drought stresses are being carried out with crops like soybean, guar, green gram, etc. during kharif season and with wheat, jowar, chickpea, sorghum and sugarcane in rabi season. Additionally, eight new plots have been developed and put under rainfed forages like marvel grass, stylo, anjan grass and irrigated Napier grass.

The north-east side farm was terraced and put under various orchards to evaluate the impact of edaphic and drought stresses on horticultural crops. About four hectare of northwest side farm includes a water balancing tank and a playground has been developed. The farm is further subdivided into two blocks with seven experimental plots. A water storage tank of 80 lakh liters has also been constructed for providing drip irrigation to the orchard crops.



South farm



North farm



Lemon orchard



Dragon fruit orchard



Grape orchard



Date-palm orchard

Model Herbal Garden

Model herbal medicinal garden named as ‘Sanjeevani Garden’ was developed under the financial assistance of NMPB, New Delhi. Medicinal plant species are Bonduc, Bael, Coral tree, Neem, Palash, Simaruba, Skikakayi, Putranjeeva, Soap nut, Shami, Shivan, Terminalia species, Wood apple, Mahua, Hirda, Behda, Curry leaf, Lime, Kutaj, Sesbania, Nirgudi, Henna, Guggal, Eucalyptus, Red Sanders, Parijatha, Jasmine, Gunj, Mapia foetida, Nagkesar, Surangi and aromatic grasses.



Herbal garden

Livestock Research Farm

A low cost livestock experimentation facility has been developed. The facility consists of cattle, goat and poultry sheds, which will be used for housing the animals for carrying out studies related to abiotic stresses in large and small ruminants and poultry birds.



Livestock experiment facility



Buffalo



Poultry shed



Goat shed

Fisheries Research Farm

The ICAR-NIASM has a modern facility to study the effect of abiotic stresses on fish. The glass aquarium, plastic rectangular tank, FRP tank and other kinds of facilities are available with this institute. The wet laboratories have facilities to conduct experiments in both ornamental and food fishes. The wet laboratory also have dissection unit for collection of different sample after completion of experiments. The institute has three farm ponds for fish rearing and maintenance of fish brood stock and screening of different abiotic stress management in pond systems.



Technologies Developed by the Institute

Institute has developed various technologies for addressing the issues of water scarcity, management of drought and edaphic stress in orchards, pollution due to burning of trash. The institute has also demonstrated the innovating planting technologies for establishment of various orchards. These technologies have been demonstrated at the institute and farmers field.

1. Transforming barren rocky basaltic terrain into cultivation of arable crops

Institute has developed technology for transforming uncultivable rocky basaltic terrain into productive land involving the following steps: (i) Ripping and chaining by heavy machinery, (ii) Blasting, (iii) application of spent wash, (iv) green manuring for enrichment with organic

carbon and application of SMS, and (v) leveling of fields. For developing 1 ha rocky basaltic terrain into productive land, the cost will range from Rs. 55,000-70,000/- depending upon the nature of slopes and extent of hardness. Farmers can generate an income of Rs. 60,000/- from the second year only and this income will gradually increase with the time as a result of an increase in yield due to increasing soil content.



Ripping/chaining of rocky surface



Blasting



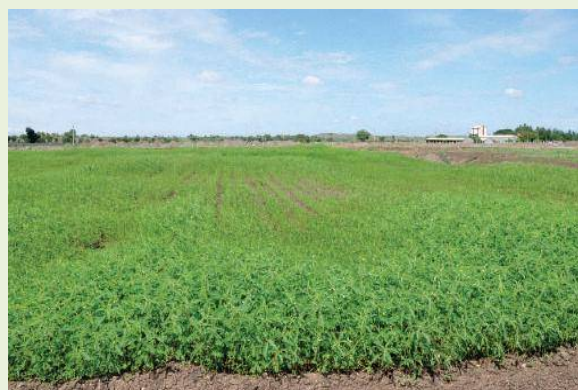
Application of spent wash



Application of spent mushroom substrate



Leveling



Growing of dhaincha plants



The initial condition of land



Condition of the land after four years

2. Innovative orchard establishment methods for obviating drought and edaphic stresses of orchards grown in shallow basaltic soils of semi-arid region

An innovative method was developed for orchard establishment to obviate drought and edaphic stresses on orchards grown in shallow basaltic soils on semi-arid region. The innovative method involving steps, (i) Ripping and chaining by heavy machineries, (ii) Blasting, (iii) sub-surface water harvesting (SSWH) along with larger pits/trenches and micro-blasting, (iv) Raised bed planting/mounding with stone pitching. About 1.0 m^3 murrum below the 1 m depth of the planting site/pit was shattered and fragmented by site specific controlled micro-blasting in order to provide greater and deeper soil volumes for root growth. The approximate cost involved per hectare in various planting methods is Rs. 2-2.5 lakhs in general and will vary as per crop type, nature of slope and extent of hardness of target land. This technology could be beneficial for improving the socio-economic status of farmers by improving the fruit productivity of horticultural crops.



Ripping/chaining of rocky surface



Micro-blasting



Pits after blasting below planting sites



Establishment of mandarin on raised beds



Performance of Mandarin orchard



Performance of Sapota orchard



Pomegranate orchard



Guava orchard



Sweet orange orchard

3. Dragon Fruit: Wonder crop for rocky barren lands and water scarce areas

Dragon fruit has been identified as a crop suitable to adopt and grow in low rainfall zone having barren land. The cultural practices and planting methods were standardized for rocky barren land in semi-arid regions of Maharashtra. Nutrient management by applying calcium and other micronutrients was also optimized for Dragon fruit cultivation. Dose response study of different type of fertilizers was also standardized. Cultivation of Dragon fruit can be a money-spinning business with an initial investment of Rs. 6-7.5 lakhs per hectare.



Planting pattern



Trellies



Flowering



Raw fruits



Ripened fruit



Drooping



Bagging



Harvested fruits



Fruit cut view

4. SORF: A multi-purpose machine for ratoon sugarcane

In situ retention of sugarcane trash can play an important role in replenishing soil quality and reducing environmental pollution. ICAR-NIASM has developed SORF machine with the inclusion of robust power transmission system, larger capacity fertilizer box and root pruning mechanisms to perform multiple operations like stubble shaving, off-baring, root pruning and placement of basal dose of fertilizers in one go while retaining the trash at the soil surface. With the use of SORF machine, ratoon cane yield can be improved by 10-38%. In the area of water scarcity and higher inputs costs, 6-21% irrigation water and 20-25% fertilizers could be saved with the use of SORF machine. This machine can perform the ratoon management operations under surface trash retained field conditions, thus trash burning which creates environmental pollution could be avoided. The one time maximum cost of SORF machine is Rs. 1.0 lakh with all accessories and net profit could be increased up to Rs. 50,000 per hectare per year.



Ratoon cane performance under SORF machine over conventional practice

5. Plant bio-regulators for enhancing productivity and quality of major crops under water-scarce regions

Plant bio-regulator based technology developed for enhancing productivity and quality of major crops under water scarce regions. The performance of bio-regulators is highly specific with environmental conditions and varies with crop to crop. In all tested crops, the application of PBRs enhanced grain yield, total biomass and water productivity. The cost of application of PBRs is normal and variable depending upon their availability in the local market and crop. Recommended doses of exogenous application of PBRs to the specific crop grown under water-scarce conditions are:





Wheat (cv. HD-2189)

Recommended PBR: Thiourea (10 mM L^{-1})

Growing stages for application:

1. Crown root initiation- 20 days after sowing
2. Flag leaf- 42-45 days after sowing
3. Seed milking stages-65 days after sowing



Sorghum (cv. Phule Suchitra)

Recommended PBR: Sodium benzoate (100 mg L^{-1})

Growing stages for application:

1. Seedling elongation-20-25 days after sowing
2. Reproductive-50 days after sowing
3. Panicle formation-75 days after sowing



Soybean (cv. JS-335)

Recommended PBR: Salicylic acid ($100 \text{ } \mu\text{M L}^{-1}$)

Growing stages for application:

1. Flag leaf- 42-45 days after sowing
2. Seed formation- 55 days after sowing



Onion (cv. Bhima Kiran)

Recommended PBR: Potassium nitrate (10 mg L^{-1})

Growing stages for application:

1. Vegetative- 40 days after sowing
2. Bulb formation-60 days after sowing
3. Bulb development-80 days after sowing
4. Post development-100 days after sowing



Eggplant (cv. Panchganga)

Recommended PBR: Salicylic acid ($10 \mu\text{m L}^{-1}$)

Growing stages for application:

1. 40 days after transplanting
2. 35 days after transplanting
3. 95 days after transplanting

6. Nano-structured material for stress alleviation in aquaculture

A process for the synthesis of silver nanoparticles using fishery wastes has been developed and characterized spectrophotometrically and microscopically. Bactericidal silver nanoparticles synthesized from tissues of *Labeo rohita*. Trapping of synthesized silver nanoparticles in zeolite has been scaled up for mitigation of ammonia in small fish ponds. Bactericidal activity of synthesized silver nanoparticle and zeolite trapped with silver nanoparticles have been determined against *Aeromonas hydrophilla*, *Vibrio harveyi* and *Pseudomonas puting* agar well diffusion method. Preparation of fish feed formulated with nanoparticles has also been standardized for its potential application for stress mitigation in fish.



Zeolite

AgNps

7. Development of a microbial-derived polymeric product for gel formation, microbial colonization and metal binding

Biopolymer was developed from *Rhizobium* strain originating from wild habitat. The product exhibited high water holding capacity, and potential to induce microbial colonization. The biopolymer can be used for mitigation of drought stress. Biological origin of product facilitate the colonization by plant growth promoting microorganisms including phosphate solubilizers and nitrogen fixers further extend applicability of the technology to promote sustainable farming with reduced dependence on chemical fertilizers.



Biopolymer developed using Rhizobium strain Evaluation of biopolymer for drought mitigation

8. Deficiency irrigation as on-farm strategy for improving water productivity of horticulture crop grown in limited water in shallow basaltic terrain

The deficit irrigation strategy was developed for improving water productivity of various horticultural crops grown in limited water in shallow basaltic terrain. This technology was tested in tomato, papaya and pomegranate crops grown in shallow murum soil. The deficit irrigation strategies helps in minimizing the yield loss 5-8% and increase in water productivity 10-15% under limited water conditions. It also helps in reducing the energy cost on drip irrigation by 10-12% for horticulture crops.



Tomato



Papaya



Pomegranate crop

9. Mixed silage of sugarcane tops for sustaining milk production during scarcity periods in drought prone areas

Cattle camps are organised for sustaining the period of acute crisis of forages during summer/water scarcity periods. Being the sugarcane belt sugarcane tops are available in plenty. Bag silage with sugarcane tops and its various combinations with fodder jowar prepared and evaluated in lactating buffaloes. The mixed silage particularly 50% ST with Jowar fodder revealed better acceptance in terms of feed intake and preference by animals. Mixed silage of sugarcane tops may be used for sustained production of dairy animals during acute crisis of water scarcity periods if prepared well in advance during their availability period i.e., winter.





Silage production in bags from sugacane tops and fodder Jowar. *Inset-* Buffaloes consuming the silage.

Publications

2019

- Harisha, C.B., Asangi, H., Singh, R. (2019). Growth, seed yield, water and nutrient use efficiency of coriander (*Coriandrum sativum* Benth.) as affected by varied irrigation levels and fertigation practices. *Indian Journal of Agricultural Sciences* 89 (7): 1167–72.
- Kumar, N., Krishnani, K.K., Singh, N.P. (2019) Effect of zinc on growth performance and cellular metabolic stress of fish exposed to multiple stresses. *Fish Physiology and Biochemistry*. DOI: 10.1007/s10695-019-00719-1.
- Kumar, N., Brahmchari, R.K., Bhushan, S., Khorat, S.T., Kumar, P., Chandan, N.K., Kumar, M., Singh, N.P. (2019) Synergistic effect of dietary selenium nanoparticles and riboflavin on the enhanced thermal efficiency of fish against multiple stress factors. *Journal of Thermal Biology*. 85:102417.
- Kumar, N., Gupta, S., Bhushan, S., Narendra Pratap Singh (2019). Impacts of acute toxicity of arsenic (III) alone and with high temperature on stress biomarkers, immunological status and cellular metabolism in fish. *Aquatic Toxicology*. 214: 105233
- Kumar, N., Krishnani, K.K., Singh, N.P. (2019). Oxidative and Cellular Metabolic Stress of Fish: An Appealing Tool for Biomonitoring of Metal Contamination in the Kolkata Wetland, a Ramsar Site. *Archives of Environmental Contamination and Toxicology*. 76:469-482.
- Kumar, N., Singh, N.P. (2019). Effect of dietary selenium on immuno-biochemical plasticity and resistance against *Aeromonas veronii* biovar *sobria* in fish reared under multiple stressors. *Fish and Shell fish Immunology*. 84: 38-47.

- Rane, J., Singh, A.K., George, P., Govindasamy, V., Cukkemane, A., Raina, S.K., Chavan, M.P., Aher, L., Sunoj, V.J., Singh, N.P. (2019). Effect of Cow Urine-Based Bioformulations on Growth and Physiological Responses in Mungbean Under Soil Moisture Stress Conditions. Proceedings of the National Academy of Sciences, India Section B: Biological Sciences. <https://doi.org/10.1007/s40011-019-01088-8>.
- Raina, S.K., Govindasamy, V., Kumar, M. Singh A.K., Rane J., Minhas, P.S. (2019) Physiological traits reveal potential for identification of drought tolerant mungbean [*Vigna radiata* (L.) Wilczek] genotypes under moderate soil-moisture deficit. Indian J. Genet., 79(2) 427-437. Doi: 10.31742/IJGPB.79.2.6
- Rane, J., Sharma, D., Ekatpure, S., Aher, L., Kumar, M., Prasad, SVS., Nankar, AN., Singh, NP (2019). Relative tolerance of photosystem II in spike, leaf, and stem of bread and durum wheat under desiccation. Photosynthetica, 57(4), 1100-1108. doi: 10.32615/ps.2019.111.
- Singh, J., Nangare, D.D., Meena, V.S., Sabir, N., Bhushan, B., Bhatnagar, P.R. (2019). Influence of different insect-net screen houses on tomato (*Lycopersicum esculentum*) plant growth, pest infestation and fruit quality in semi-arid region. Annals of plant protection sciences. 27(1): 54-60.
- Taria, S., Rane J., Alam B., Kumar M., Babar, R., Anuragi H, Rajarajan K., Singh NP. (2019) Combining IR imaging, chlorophyll fluorescence and phenomic approach for assessing diurnal canopy temperature dynamics and desiccation stress management in *Azadirachta indica* and *Terminalia mantaly*, Agroforest Syst <https://doi.org/10.1007/s10457-019-00461-w>

2018

- Kumar, N. , Krishnani, K.K., Kumar, P., Sharma, R., Baitha, R., Singh, D.K., Singh, N.P. (2018). Dietary nano-silver: Does support or discourage thermal tolerance and biochemical status in air-breathing fish reared under multiple stressors? Journal of Thermal Biology. 77: 111-121.
- Kumar, N., Krishnani, K.K., Gupta, S.K., Sharma, R., Baitha, R., Singh, D.K., Singh, N.P. (2018). Immuno-protective role of biologically synthesized dietary selenium nanoparticles against multiple stressors in Pangasianodon hypophthalmus. Fish and Shellfish Immunology. 78:289-298.
- Kumar, N., Krishnani, K.K., Gupta, S.K., Singh, N.P. (2018). Effects of silver nanoparticles on stress biomarkers of Channa striatus: immuno-protective or toxic?. Environmental Science and Pollution Research. DOI: 10.1007/s11356-018-1628-8.
- Kumar, N., Krishnani, K.K., Singh, N.P. (2018). Effect of dietary zinc-nanoparticles on growth performance, anti-oxidative and immunological status of fish reared under multiple stressors. Biological Trace Element Research DOI: 10.1007/s12011-018-1285-2.
- Kumar, N., Krishnani, K.K., Singh, N.P. (2018). Comparative study of selenium and selenium nanoparticles with reference to acute toxicity, biochemical attributes and histopathological response in fish. Environmental Science and Pollution Research. 25: 8914–8927. DOI: 10.1007/s11356-017-1165-x.

Raina, S.K., Yadav, P.S., Singh, A.K., Raskar, N., Rane, J., Minhas, P.S. (2018) Exogenous gibberellic acid does not induce early flowering in mungbean (*Vigna radiata* (L.) Wilczek). Legume Research DOI: 10.18805/LR-4037.

Wakchaure, G.C., Minhas, P.S., Meena, K.K., Singh, N.P., Hegade, P.M., Sorty, A.S., 2018. Growth, bulb yield, water productivity and quality of onion (*Allium cepa* L.) as affected by deficit irrigation regimes and exogenous application of plant bio-regulators. Agricultural Water Management, 199, 1–10. <https://doi.org/10.1016/j.agwat.2017.11.026>

2017

Basavaraj, S., Deb, R., Raina, S.K., Pawar, S.S., Brahmane, M.P., Nirmale, A.V., Kurade, N.P., Reddy, G.B.M., Bal, S.K., Singh, N.P. (2017). Untranslated regions (UTRs) orchestrate translation reprogramming in cellular stress responses. Journal of Thermal Biology, 65: 69–75.

Bhagat, K.P., Bal, S.K., Singh, Y., Potekar, S., Saha, S., Ratanakumar, P., Wakchaure, G.C., Minhas, P.S. (2017). Effect of reduced PAR on growth and photosynthetic efficiency of soybean genotypes. Journal of Agrometeorology, 19:1–9

Choudhary, R.L., Wakchaure, G.C., Minhas, P.S., Singh, A.K. (2017). Response of Ratoon Sugarcane to Stubble Shaving, Off-barring, Root Pruning and Band Placement of Basal Fertilisers with a Multi-purpose Drill Machine. Sugar Tech 19(1):33–40. DOI 10.1007/s12355-016-0438-x.

Govindasamy, V., Raina, S.K., George, P., Kumar, M., Rane, J., Minhas, P.S., Vittal, K.P.R. (2017). Functional and phylogenetic diversity of cultivable rhizobacterial endophytes of sorghum (*Sorghum bicolor* (L.) Moench). Antonie van Leeuwenhoek, 110 (7):925–943.

Hanjagi, P.S., Singh, B. (2017). Interactive regulation of iron and zinc nutrition in wheat (*Triticum aestivum* L.). Indian Journal of Plant Physiology, 22:70–78

Kumar, N., Krishnani, K.K., Kumar, P., Singh, N.P. (2017). Zinc nanoparticles potentiates thermal tolerance and cellular stress protection of *Pangasius hypophthalmus* reared under multiple stressors. Journal of Thermal Biology, 70: 61–68

Kumar, N., Krishnani, K.K., Gupta, S.K., Singh, N.P. (2017). Selenium nanoparticles enhanced thermal tolerance and maintain cellular stress protection of *Pangasius hypophthalmus* reared under lead and high temperature. Respiratory Physiology and Neurobiology. S1569-9048(17)30252-5

Kumar, N., Krishnani, K.K. and Singh, N.P. (2017). Oxidative and cellular stress as bioindicators for metals contamination in freshwater mollusk *Lamellidens marginalis*. Environmental Science and Pollution Research. DOI: 10.1007/s11356-017-9266-0

Kumar, N., Krishnani, K.K., Brahmane, M.P., Gupta, S.K., Kumar, P., Singh, N.P. (2017). Temperature induces lead toxicity in *Pangasius hypophthalmus*: An acute test, antioxidative status and cellular metabolic stress. International Journal of Environmental Science and Technology. DOI 10.1007/s13762-017-1364-5.

- Kumar, N., Krishnani, K.K., Kumar, P., Jha, A.K., Gupta, S.K., Singh, N.P. (2017). Dietary zinc promotes biochemical plasticity and protects fish against multiple stresses. *Fish and Shellfish Immunology*, 62:184-194
- Kumar, N., Krishnani, K.K., Gupta, S.K. and Singh, N.P. (2017). Cellular stress and histopathological tools used as biomarkers in *Oreochromis mossambicus* for assessing metal contamination. *Environmental Toxicology and Pharmacology*, 49:137-147
- Kumar, N., Krishnani, K.K., Meena, K.K., Gupta, S.K., Singh, N.P. (2017). Oxidative and cellular metabolic stress of *Oreochromis mossambicus* as biomarkers indicators of trace element contaminants. *Chemosphere*, 171:265-274
- Kumar, M., Raina, S.K., Govindasamy, V., Singh, A.K., Choudhary, R.L., Rane, J. and Minhas, P.S. (2017). Assimilates mobilization, stable canopy temperature and expression of expansin stabilizes grain weight in wheat cultivar LOK-1 under different soil moisture conditions. *Botanical Study*, 58:14
- Meena, K.K., Sorty, A.M., Bitla, U.M., Choudhary, K., Gupta, P., Pareek, A., Singh, D.P., Prabha, R., Sahu, P.K., Gupta, V.K., Singh, H.B., Krishnani, K.K., Minhas, P.S. (2017). Abiotic stress responses and microbe-mediated mitigation in plants: The omics strategies. *Frontiers in Plant Science*, 8 (172):1-25
- Rane, J., Kaledhonkar, M.J., Sharma, P.C., Singh, N.P. (2017). Improvement of Salt tolerance in crop plants: Emerging, opportunities in plant phenomics. *Journal of Soil Salinity and Water Quality*, 9(1):47-52
- Sajjanar, B., Deb, R., Raina, S.K., Pawar, S.S., Brahmane, M.P., Nirmale, A.V., Kurade, N.P., Reddy, G.B.M., Bal, S.K., Singh, N.P. (2017). Untranslated regions (UTRs) orchestrate translation reprogramming in cellular stress responses. *Journal of Thermal Biology*, 65:69-75

2016

- Choudhary, R.L., Wakchaure, G.C., Minhas, P.S., Singh, A.K. (2016). Response of ratoon sugarcane to stubble shaving, off-barring, root pruning and band placement of basal fertilisers with a multi-purpose drill machine. *Sugar Tech*, doi 10.1007/ s12355-016-0438-x
- Krishnani, K.K. (2016). Lignocellulosic wheat straw-derived ion-exchange adsorbent for heavy metals removal. *Applied Biochemistry and Biotechnology*. 178(4): 670-686.
- Kumar, N., Ambasankar, K., Krishnani, K.K., Gupta, S.K., Bhushan, S., Minhas, P.S. (2016). Acute toxicity, biochemical and histopathological responses of endosulfan in *Chanos chanos*. *Ecotoxicology and Environment Safety*, 131:79-88
- Kumar, N., Ambasankar, A., Krishnani, K.K., Bhushan, S., Minhas, P.S. (2016). Dietary pyridoxine protects against stress and maintains immune-hematological status in *Chanos chanos* exposed to endosulfan. *Basic & Clinical Pharmacology & Toxicology*. doi: 10.1111/bcpt.12589
- Kumar, N., Ambasankar, K., Krishnani, K.K., Gupta, S.K., Minhas, P.S. (2016). Dietary pyridoxine promotes growth and cellular metabolic plasticity of *Chanos chanos*

- fingerlings exposed to endosulfan induced stress. *Aquaculture Research*. doi:10.1111/are.13042
- Kumar, N., Ambasankar, K., Krishnani, K.K., Kumar, P., Akhtar, M.S., Bhushan, S. and Minhas, P.S. (2016). Dietary pyridoxine potentiates thermal tolerance, heat shock protein and protect against cellular stress of Milk fish (*Chanos chanos*) under endosulfan-induced stress. *Fish and Shellfish Immunology*, 55:407-414
- Nangare, D.D., Suresh Kumar, P., Singh, Y., Minhas P.S. (2016). Growth, fruit yield and quality of tomato (*Lycopersicon esculentum* Mill.) as affected by deficit irrigation regulated on phenological basis. *Agricultural Water Management*. doi: 10.1016/j.agwat.2016.03.016
- Pawar, S.S., Sajjanar, B., Lonkar, V.D., Kurade, N.P., Kadam, A.S., Nirmale, A.V., Brahmane, M.P., Bal, S.K. (2016). Assessing and Mitigating the Impact of Heat Stress in Poultry. *Advances in Animal and Veterinary Sciences*, 4:332-341
- Raina, S.K., Govindasamy, V., Kumar, M., Singh, A.K., Rane, J., Minhas, P.S. (2016). Genetic variation in physiological responses of mungbeans (*Vigna radiata* (L.) Wilczek) to drought. *Acta Physiol Plant*, 38: 263
- Ratnakumar P, Khan M.I.R., Minhas P.S., Sultana R., Per T. S, Deokate P.P., Khan N.A., Singh Y., Rane J. (2016). Can plant bio-regulators minimize the crop productivity losses caused by drought, heat stress and salinity? An integrated review. *Journal of Applied Botany and Food Quality*. Vol. 89. doi:10.5073/JABFQ.2016.089.00X
- Ratnakumar, P., Minhas, P.S., Wakchaure, G.C., Choudhary, R.L., Deokate, P.P. (2016). Yield and water production functions of wheat (*Triticum aestivum* L.) cultivars and response to exogenous application of thiourea and ortho-silicic acid. *International Journal of Agriculture and Environmental Research*, 2:1628-1950
- Saha, S., Bal, S.K., Bhagat, K. (2016). Fluxes and production efficiency of irrigated wheat ecosystem under edaphic constraints of Western Maharashtra plateau: a micrometeorological investigation. *Journal of Agrometeorology*, 18:175-183.
- Sorty, A.M., Meena, K.K., Choudhary, K., Bitla, U.M., Minhas, P.S., Krishnani, K.K. (2016). Effect of plant growth promoting bacteria associated with halophytic weed (*Psoralea corylifolia* L.) on germination and seedling growth of wheat under saline conditions. *Applied Biochemistry and Biotechnology*, 180(5): 872-882.
- Wakchaure, G.C., Minhas, P.S., Pasala, R.K., Choudhary, R.L. (2016). Effect of bioregulators on growth, yield and water production functions of sorghum (*Sorghum bicolor* (L.) Moench). *Agricultural Water Management*, 177: 138-145
- Wakchaure, G.C., Minhas, P.S., Pasala, R.K., Choudhary, R.L. (2016). Optimising supplemental irrigation for wheat (*Triticum aestivum* L.) and the impact of plant bio-regulators in a semi-arid region of Deccan Plateau in India. *Agricultural Water Management*, doi 10.1016/j.agwat.2016.04.004
- Wakchaure, G.C., Das, L., Kolar, P., (2016). Eggshell as an inexpensive adsorbent for mitigation of p-cresol. *Transactions of the ASABE* (Transactions of American Society

of Agricultural and Biological Engineers), 59 (3), 965–974. DOI 10.13031/trans.59.11340.

2015

- Fand, B.B., Sul, N.T., Bal, S.K., Minhas, P.S. (2015). Temperature impacts the development and survival of common cutworm (*Spodoptera litura*): simulation and visualization of potential population growth in India under warmer temperatures through life cycle modeling and spatial mapping. PLOS ONE, DOI: 10.1371/journal.pone.0124682
- Govindasamy, V., Senthilkumar, M., Annapurna, K. (2015). Effect of mustard rhizobacteria on wheat growth promotion under cadmium stress: characterization of *acdS* gene coding ACC deaminase. Annals of Microbiology 65 (3): 1679-1689
- Krishnani, K.K., Kathiravan, V. (2015). Functional gene based multiplex PCR to detect bacteria implicated in biotransformation of nitrogen, sulfur and methane in aquatic environment. Indian Journal of Biotechnology, 14, 482-488
- Krishnani, K.K., Boddu, V.M., Moon, D.H., Ghadge, S.V., Sarkar, B., Brahmane, M.P., Choudhar, K., Kathirvan, V., Meng, X. (2015). Metals Bioaccumulation Mechanism in Neem Bark. Bull. Environ. Contam. Toxicol. 95:414–419
- Krishnani, K.K., Kathiravan, V., Shakil, N.A., Singh, M., Brahmane, M.P., Meena, K.K., Sarkar, B., Choudhary, K., Singh, Mukesh, Kumar, J. (2015). Bactericidal activity of nanoparticles against shrimp pathogenic bacterium *Vibrio harveyi*. Proceedings of National Academy of Sciences, India, Section Biological Sciences 85(4):1079–1086
- Meena, K.K., Kumar, M., Mishra, S., Ojha, S.K., Wakchaure, G.C., Sarkar, B. (2015). Phylogenetic study of methanol oxidizers from Chilika-lake sediments using genomic and Metagenomic approaches. Indian Journal of Microbiology 55 (2), 151-162
- Meena, R.L., Idnani, L.K., Kumar, M., Khanna, M., Shukla, L., Choudhary, R.L. (2015). Water economization in rabi maize (*Zea mays* L.) to enhance productivity through land configuration and irrigation scheduling in the Indo-Gangetic Plains of India. Journal of Soil and Water Conservation 14(1): 49–55.
- Minhas, P.S., Yadav, R.K., Khajanchi-Lal, Chaturvedi, R.K. (2015) Effect of long-term irrigation with wastewater on growth, biomass production and water use by *Eucalyptus tereticornis* planted at variable stocking density. Agricultural Water Management. 152(4): 151-160
- Minhas, P.S., Khajanchi-Lal, Yadav, R.K., Dubey, S.K., Chaturvedi, R.K. (2015) Long-term impact of waste water irrigation and nutrient rates, I. Performance, sustainability and produce quality of peri-urban cropping systems. Agricultural Water Management:156:100-109
- Pawar, S.S., Meshram, C.D., Singh, N.K., Saini, M., Mishra, B.P., Gupta, P.K. (2015). Loop-Mediated Isothermal Amplification for Rapid Detection and Differentiation of Wild-Type Bovine Herpesvirus-1 and Glycoprotein E-Deleted Marker Vaccine Strain. Animal Biotechnology. 26(4): 268-272

- Sajjanar, B., Deb, R., Singh, U., Kumar, S., Brahmane, M.P., Nirmale, A., Bal, S.K., Minhas, P.S. (2015). Identification of SNP in HSP90AB1 and its association with relative thermotolerance and milk production traits in Indian dairy cattle. *Animal Biotechnology*, 26: 45-50
- Sarkar, B., Bhattacharjee, S., Daware, A., Tribedi, P., Krishnani, K.K., Minhas, P.S. (2015). Selenium nanoparticles for stress-resilient fish and livestock. *Nanoscale Research Letters* 10(1): 371. doi: 10.1186/s11671-015-1073-2
- Suresh Kumar P, Singh Y, Nangare, D.D, Bhagat, K, Kumar. M, Taware P.B, Anjali Kumari, Minhas P.S. (2015). Influence of growth stage specific water stress on yield, physio-chemical quality and functional characteristics of tomato grown in shallow basaltic soils. *Scientia Horticulture* 197:261-271
- Wakchaure, G. C., Choudhary, R. L., Kaledhonkar, M. J., Bal, S. K. (2015). Effect of precision land levelling on micro-environment and sorghum productivity in water scarce Deccan region. *Journal of Agrometeorology*, 17(2), 149-157

2014

- Bansal, K.C., Singh, A.K. (2014). Plastid transformation in eggplant- *Solanum melongena*. *Methods in Molecular Biology*, 1132: 305-316.
- Choudhary, R.L., Behera, U.K. (2014). Effect of sequential tillage practices and N levels on soil health and root parameters in maize (*Zea mays*) – wheat (*Triticum aestivum*) cropping system. *Journal of Soil and Water Conservation*, 13(1): 73–82
- Fand, B.B., Tonnang, H.E.Z., Kumar, M., Bal, S.K., Singh, N.P., Rao, D.V.K.N., Kamble, A. L., Nangare, D.D., Minhas, P.S. (2014). Predicting the impact of climate change on regional and seasonal abundance of the mealybug *Phenacoccus solenopsis* Tinsley (Hemiptera: Pseudococcidae) using temperature-driven phenology model linked to GIS. *Ecological Modelling*, 288: 62–78.
- Fand, B.B., Kumar, M., Kamble, A.L. (2014). Predicting potential geographic distribution of cotton mealybug *Phenacoccus solenopsis* Tinsley. (Hemiptera: Pseudococcidae) based on MAXENT Ecological Niche Model. *Journal of Environmental Biology*, 35(3).
- Fand, B.B., Tonnang, H.E.Z., Kumar, M., Kamble, A.L., Bal, S.K. (2014). A temperature-based phenology model for predicting development, survival and population growth potential of mealybug, *Phenacoccus solenopsis* Tinsley. (Hemiptera: Pseudococcidae). *Crop Protection*, 55: 98-108
- Fand, B.B., Tonnang, H.E.Z., Kumar, M., Kamble, A.L., Bal, S.K. (2014). A temperature-based phenology model for predicting development, survival and population growth potential of mealybug, *Phenacoccus solenopsis* Tinsley. (Hemiptera: Pseudococcidae). *Crop Protection*, 55: 98-108.
- Kumar, M., Ahuja, S., Dahuja, A., Kumar, R., Singh, B. (2014). Gamma radiation protects fruit quality in tomato by inhibiting the production of reactive oxygen species (ROS) and ethylene. *Journal of Radio analytical and Nuclear Chemistry*, 301(3):871-880

- Kumar, M., Singh, B., Ahuja, S., Dahuja, A., Anand, A. (2014). Gamma radiation and magnetic field mediated delay in effect of accelerated ageing of soybean. *Journal of Food Science and Technology*. DOI. 10.1007/s13197-014-1590-5
- Kumar, N., Minhas, P.S., Ambasankar, K., Krishnani, K.K., Rana, R.S. (2014). Dietary lecithin potentiates thermal tolerance and cellular stress protection of milk fish (*Chanos chanos*) reared under low dose endosulfan induced stress. *Journal of Thermal Biology*, 46: 40-46
- Krishnani, K.K., Hao, M.X.J., Mulchandani, A. (2014). Bactericidal activity of elastin-like polypeptide biopolymer with poly histidine domain and silver, *Colloids and Surfaces B: Biointerfaces*.
- Pawar, S.S., Meshram, C.D., Singh, N.K., Sonwane, A.A., Saini, M., Rautmare, S.S., Muglikar, D.M., Mishra, B.P., Gupta, P.K. (2014). Rapid detection of bovine herpesvirus-1 in bovine semen by loop mediated isothermal amplification (LAMP) assay. *Archives of Virology*, 159(4): 641-648
- Saha, S., Bal, S.K., Singh, Y., Minhas, P.S. (2014). Net carbon-dioxide exchange in green manuring ecosystem, *Sesbania aculeata*: assessment through eddy covariance approach. *Journal of Agrometeorology*, 16: 149-156.
- Suresh Kumar, P., Sagar, V.R. (2014). Drying characteristics of osmosed mango, guava and aonla. *Journal of Agricultural Engineering*, 51(1): 31-36
- Suresh Kumar, P., Sagar, V.R. (2014). Drying kinetics and physico-chemical characteristics of osmo-dehydrated mango, guava and aonla under different drying conditions. *Journal of Food Science Technology*, 51(8): 1540-1546

2013

- Bal, S.K., Choudhury, B.U., Sood, A., Saha, S., Mukherjee, J., Singh, H., Kaur, P. (2013). Relationship between leaf area index of wheat crop and different spectral indices in Punjab. *Journal of Agrometeorology*, 15(2): 98-102
- Choudhary, R.L., Kumar, D., Shivay, Y.S., Anand, A., Nain, L. (2013). Yield and quality of rice (*Oryza sativa*) hybrids grown by SRI method with and without plant growth promoting Rhizobacteria. *Indian Journal of Agronomy*, 58(3): 430-433
- Choudhary, R.L., Behera, U.K. (2013). Effect of sequential tillage practices and N levels on energy relations and use-efficiencies of irrigation water and N in maize (*Zea mays*) - wheat (*Triticum aestivum*) cropping system. *Indian Journal of Agronomy*, 58(1): 27-34
- Fand, B.B., Tonnang, H.E.Z., Kumar, M. Kamble, A.L., Bal, S.K. (2013). Temperature-based phenology modeling and GIS-based risk mapping: A tool for forecasting potential changes in the abundance of mealybug *P. solenopsis*. In: Abstract of the "IVth International Insect Science Congress", UAS, Bangalore, February 14-17, 2013. pp. 9-10.

- Kaledhonkar, M.J., Gupta, S.K., Saxena, C.K., Sharma, D.P., Kumar, A. (2013). Emerging issues due to adoption of submersible pump technology in marginal quality areas of Haryana. *Journal of Agricultural Engineering*, 50(4): 58-64
- Nangare, D.D., Singh, K.G., Kumar, S. (2013). Effect of blending fresh-saline water and discharge rate of drip on plant yield, water use efficiency (WUE) and quality of tomato in semi-arid environment. *African Journal of Agricultural Research*, 8(27): 3639-3645
- Rao, D.V.K.N. (2013). Volume based expression of soil variables: Good descriptor of soil-plant interrelationships. *Scientific Research and Essays*, 8(29):1380-1388
- Ratnakumar, P., Rajendrudu, G., Swamy, P.M. (2013). Photosynthesis and growth responses of peanut (*Arachis hypogaea* L.) to salinity at elevated CO₂. *Plant Soil & Environment*, 59 (9): 410-416
- Sarkar, B., Netam, S.P., Mohanty, A., Saha, A., Basu, R., Krishnani, K.K. (2013). Toxicity evaluation of chemically and plant derived silver nanoparticles on zebra fish (*Danio rerio*). *Proceedings of the National Academy of Sciences, India Section B: Biological Science*.
- Sarkar, B., Mahanty, A., Saha, A., Pal, A.T., Bandyopadhyaya, P., Sarkar, S.K., Adhikari, S., Ayyappan, S. (2013). Impact of cypermethrin and carbofuran on the ovarian cycle of the Indian major carp, *Labeo rohita* (Hamilton). *Proceedings of National Academy of Science B. Biological Science*.
- Sureshkumar, P., Kanwat, M., Choudhary, V.K. (2013). Mathematical modelling and thin-layer drying kinetics of bamboo slices on convective tray drying at varying temperature. *Journal of Food Processing and Preservation*, 37: 914-923
- Sureshkumar, P., Choudhary, V.K., Kanwat, M., Sangeetha, A. (2013). Influence of different sources of nutrients on growth, yield and quality of Khasi mandarin grown under mid hills of Arunachal Pradesh. *Journal of Applied Horticulture*, 15(3): 220-223
- Sureshkumar, P., Choudhary, V.K., Kanwat, M., Sangeetha, A. (2013). Effect of some process variables on mass transfer kinetics during osmotic dehydration of bamboo slices. *International Food Research Journal*, 20(5): 2211-2127
- Wakchaure, G.C., Meena, K.K., Choudhary, R.L., Singh, M., Yandigeri, M.S. (2013). An improved rapid composting procedure enhances the substrate quality and yield of *Agaricus bisporus*. *African Journal of Agricultural Research*, 8(35): 4523-4536
- Wakchaure, G.C., Singh, M. (2013). Zero energy polytunnel: a rapid composting method for *Agaricus bisporus* cultivation. *Mushroom Research*, 22(1): 9-18

2012

- Bansal, K.C., Singh, A.K., Wani, S.H. (2012). Plastid transformation for abiotic stress tolerance in plants. *Methods in Molecular Biology*. 913: 351-358.

Fand, B.B., Kamble, A.L., Kumar, M. (2012). Will climate change pose serious threat to crop pest management? A critical review International Journal of Scientific and Research Publications, 2: 1-15.

Books/Book Chapters

2019

Krishnani KK, Kathiravan V, Meena KK, Sarkar B. (2019) Bioremediation of Aquatic Toxicants: Application of Multi-Omic Approaches. Advances in Fish Research. Vol. VII. (Ed. Mohanty, B.P.) New Delhi: Narendra Publishing House.

Kumar, N, Kumar P, Singh NP (2019) Thermal Adaptation and Mitigation of Aquatic Animal through Different Approaches. "Perspectives on Inland Fisheries & Climate Change in India. ISBN: 0970-616X Chapter No. 24. Pp 390-406.

Singh, NP, Kumar N (2019) The role and concept of stress in aquatic animals. National Seminar on "Climate Smart Aquaculture and Fisheries (CSAF)" organised at College of Fisheries, Central Agricultural University (Imphal), Tripura along with All India Congress of Zoology (31st AICZ) organized during January 15-16, 2019.

2018

Govindasamy V, George P, Raina SK, Kumar M, Rane J, Annapurna, K (2018) Plant-Associated Microbial Interactions in the Soil Environment: Role of Endophytes in Imparting Abiotic Stress Tolerance to Crops. In: Advances in Crop Environment Interaction (Eds. Bal, S.K., Mukherjee, J., Choudhury, B.U., Dhawan, A.K.). Springer-Verlag, GmbH, Heidelberg, Germany. Pp 245-284.

Singh AK, Kumar M, Choudhary D, Rane J, Singh NP (2018) RNAi approach: a powerful technique for gene function studies and enhancing abiotic stress tolerance in crop plants. In: Biotechnologies of Crop Improvement, Vol II, Transgenic Approaches. Gosal SS and Wani SH (Eds.), Springer International Publishing AG, Cham, USA. pp 25-39.

Singh AK, Kumar M, Choudhary D, Rane J, Singh NP (2018) Virus-Induced Gene Silencing Approach: A potential functional genomics tool for rapid validation of Function of genes associated with abiotic stress tolerance in crop plants. In: Biotechnologies of Crop Improvement, Vol II, Transgenic Approaches, Gosal SS and Wani SH (Eds.). Springer International Publishing AG, Cham, USA. pp 113-127.

2015-2017

Minhas PS, Rane J, Pasala RK (2017) Abiotic Stress Management for Resilient Agriculture. Springer Singapore, Pp. 517

Sarkar, B., Dawre, A., Bhattacharya, S., Trivedi, P., Krishnani, K.K., Minhas, P.S. (2015). Nanotechnology heralds a new dawn in stress prone aquaculture. In: Ayyappan, S. and Mahanty, B.P. (Ed), Advances in Fish Research, Volume VI, Narendra Publication House, New Delhi, India.

2013-14

- Bhagat, K.P., Kumar, R. A., Ratnakumar, P., Kumar, S., Bal, S.K., Agrawal, P.K. (2014). Photosynthesis and associated aspects under abiotic stresses environment. In: R.K. Gaur and P. Sharma (Eds.), *Approaches to Plant Stresses and their Management*, Springer (India) Pvt. Ltd., pp. 191-205
- Bhagawati, R., Sureshkumar, P., Choudhary, V.K., Kanwat, M. (2013). Medicinal and Aromatic Plants: An alternate farming option and sustainable income source for farmers. In: N. Prakash, S.S. Roy, P.K. Sharma and S.V. Ngachan (Eds.), *Developing the Potential of Underutilized Horticultural Crops of Hill Regions*. Today and Tomorrow's Printers and Publishers. New Delhi, pp. 405-430
- Fand, B.B., Choudhary, J.S., Kumar, M., Bal, S.K. (2014). Phenology modeling and GIS applications in pest management: A tool for studying and understanding insect pest dynamics in the context of global climate change. In: R.K. Gaur and P. Sharma (Eds.) *Approaches to Plant Stresses and their Management*, Springer (India) Pvt. Ltd, pp. 107-124
- Govindasamy, V., Franco, C.M.M., Vadakattu, V.S.R.G. (2014). Endophytic actinobacteria: diversity and ecology. In: V.C. Verma and A.C. Gange (Eds.), *Advances in Endophytic Research*, Springer-Verlag, GmbH, Heidelberg, Germany. pp. 27-59
- Ratnakumar, P., Raina, S.K., Kumar, S., Bhagat, K.P., Singh, Y., Bal, S.K. (2014). Adaptation and Mitigation Strategies of Plant under Drought and High Temperature Stress. In: N.Tuteja and S.S. Gill (Eds.), *Abiotic Stress and Climate Change*, Wiley-Blackwell, Germany, Vol. (2), pp. 421-436
- Sureshkumar, P., Minhas, P.S., Govindasamy, V., Choudhary, R. L. (2014). Influence of moisture stress on growth, development, physiological process and quality of fruits and vegetables and its management strategies. In: R.K.Gaur and P. Sharma (Eds.), *Approaches to Plant Stresses and their Management*, Springer (India) Pvt. Ltd. pp. 125-148
- Singh, U., Sureshkumar, P. (2013). *Glimpses of post-harvest technology*. New Vishal Publications. New Delhi. pp. 1-278
- Sureshkumar, P., Chaudhary, V.K., Bhagawati, R., Devi, M.P., Bagra, G. (2013). Underutilized fruits and vegetable crops of Arunachal Pradesh. In: N. Prakash, S.S. Roy, P.K. Sharma and S.V. Ngachan (Eds.), *Developing the Potential of Underutilized Horticultural Crops of Hill Regions*. Today and Tomorrow's Printers and Publishers. New Delhi. pp. 127-169.

Trainings/Workshops Conducted

Multi-omics Approaches to Alleviate Abiotic Stress in Post Genomic Era: Methods and Application in Microbiological Research

A DBT sponsored training program on Multi-omics Approaches to Alleviate Abiotic Stress in Post Genomic Era: Methods and Application in Microbiological Research' was conducted during January 24, 2014 to February 06, 2014. No single 'omics' analysis can fully explore the intertwined nature of fundamental interactions between microbes or plants. Therefore, integration of multi-layered information through multi-omics approach is needed to generate deep insights to the plant-microbe interactions under stress. Keeping in view the importance of multi-omics technologies for efficient characterization of microbes for their better exploitation in alleviation of abiotic stress in agriculture, this training program was formulated to facilitate the implementation of omics technologies. The training program included both lectures and hands-on experiments by experts in the field of genomics, metagenomics, proteomics, metabolomics, transcriptomics and bioinformatics.



Winter School on 'Climate Change and Abiotic Stress Management Strategies for Enhancing Crop Productivity and Farmers Income'

Training program on 'Climate Change and Abiotic Stress Management Strategies for Enhancing Crop Productivity and Farmers Income' was conducted during 4-11 January 2020. This training was sponsored by Directorate of extension, Ministry of Agriculture and farmers' welfare, New Delhi. Extension functionaries from state agriculture development departments, state agricultural universities and KVKs participated. The various lectures, demonstrations on climate change and abiotic stress management, water and soil management strategies for enhancing farmers' income were given by the resource persons from the ICAR-NIASM and other institutes.



Climate-smart Technologies for Resource Conservation and Increasing Farmers' Income

ICAR-NIASM, Baramati organized 21 days “Winter School on Climate smart agricultural technologies for resource conservation and increasing farmer’s income” during November 19th to December 9th 2019. The program was sponsored by Indian Council of Agricultural Research, Ministry of Agriculture and Farmers Welfare, Govt. of India. Nineteen participants includes scientists, teachers and researchers from different parts of the country participated in this training programme. The objective of this programme was sensitizing the participants with the recent advancements in climate smart agricultural technologies. Lectures related to abiotic stress management and doubling farmers’ income in abiotic stressed areas were delivered and also hands on training on use of high-end equipment related to abiotic stress assessment was provided. The programme covered lectures; field visits; demo-sessions in the area of climate change; food security and climate smart agriculture; abiotic stresses and their mitigation strategies using microbial resources; live demonstration of planting methods in commercial crops such as sugarcane; application of Stubble shaving, Off-barring, Root pruning and Band placement of basal fertilizers (SORF) machine for advanced cultural practices in sugarcane; measurement of root dynamics using sophisticated imaging system; Infra-Red imaging system for canopy modelling; integrated farming system for small farmers to achieve sustainable income; animal husbandry fish farming and pest management under abiotic stress conditions; extraction of microbial biomolecules and subsequent analysis through HPLC; water and soil management technologies; novel microbial, biotechnological and plant-phenomics approaches for enhancing crop and water productivity were delivered by the various experts/resources persons.



Dr. Jagadish Rane addressing participants



Interaction with scientist during Winter School

Climate-smart agriculture and abiotic stress management technologies for enhancing farmers income

A collaborative training program on ‘Climate-Smart Agriculture and Abiotic Stress Management Technologies for Enhancing Farmers Income’ sponsored by the National Institute of Agricultural Extension Management (MANAGE), was organized during 16-20 December 2019. Extension functionaries from state agriculture development departments, state agricultural University and KVKs participated. Lectures, demonstrations and fields visits on climate change, abiotic stress management, water and soil management strategies for enhancing farmers income includes bio-regulators, climate smart crops, microbial, biotechnological and phonemics approaches, livestock and fish production technologies were covered in the event.



Dr. Jagadish Rane addressing during Winter School



Interaction with scientist during Winter School



Participants of collaborative training with MANAGE

Workshop on ‘advances in soil and water analysis’

A Workshop on “Advances in Soil and Water Analysis” was organized in the Institute during November 4-6, 2019. Candidates from different parts of Maharashtra attended the Workshop. Various lectures and practical sessions were on Advances in soil chemical analysis, Analysis of soil physical Parameters, Water quality: challenges and opportunities for addressing abiotic stresses in the present scenario of climate change, Advances in the assessment of soil biological diversity, How to conduct field experiments on water stress and water productivity, Soft skills for data analysis and visualization, Advanced instrumentation facility for detection of micronutrients and heavy metals in soil and water were covered during the event. Practical

sessions of the workshop were conducted on “Assessment on soil quality indicators” in which soil sampling, sample preparation in the lab (like air drying, crushing, sieving, extract preparation, etc.) and analysis of soil health parameters viz. soil bulk and particle density, pH, EC, NPK analysis etc. were covered. During the practical session of “Analysis of water quality” water sampling method (from pond, tap and bore well, well), sample preparation in the lab (for microbial, nutrient and metal analysis) and analysis of water quality parameters like pH, Electrical conductivity (EC), Oxidation reduction potential (ORP), temperature, Dissolved oxygen (DO), salinity, turbidity, TDS, alkalinity (Carbonate & Bicarbonate), hardness (Calcium + Magnesium ion), chloride, sodium, potassium, micronutrients and metal analysis, total coliform, fecal coliform and Escherichia coli etc. were covered. During workshop working of Atomic Absorption Spectrophotometer (AAS), Inductively Coupled Plasma Mass Spectroscopy (ICP-MS), Flame photometer (FES), UV/VIS-spectrophotometer have also demonstrated and also given hands on training to the participants.



NIASM staff and participant of workshop on advances in soil and water analysis



Director ICAR-NIASM address



Scientist's address during the workshop

One day workshop on ‘Climate Smart technologies for sugarcane cultivation’

The objective of organizing the workshop was to acquaint the farmers with climate smart ways for handling issues of water scarcity, trash burning and controlling pest and disease problems in changing climatic scenario. About 175 farmers and 25 guests attended the program to discuss the current status of sugarcane production, sugar recovery, issues related to the crop in Maharashtra. The workshop brought all the sugarcane based stakeholders on a single platform and discuss about the problems, innovations and good agricultural practices pertaining to sugarcane farming. Progressive farmers discussed about the problems of farmers

and sugar industries and urged farmers to adopt new technologies generated from ICAR-NIASM for better production under multiple stress condition.



Two days workshop on 'Application of Foldscope for pollen studies'

In a two days' workshop held during January 11-12, 2019, NIASM scientists demonstrated the use of portable microscope called 'Foldscope' for studies on pollens of crop plants. This was carried out under the project funded by DBT. There were 21 students and 3 teachers from Shardabai Pawar Vidyaniketan, Sharadanagar attended the workshop. On the first day of the training all were acquainted with pollen germination studies. The results were observed and recorded in the observation sheets provided. A good interactive session was there in continuation with the presentation about 'Foldscope- as an economical feasible research tool'. All the doubts in the young minds regarding these studies were clarified. On the second day, students studied temporal variation in the viability of pollens of crops in the field.



Refresher Course on 'Administration & Finance Management for Section Officers, AAOs, AFAOs & Assistants of ICAR HQ & Institutes'

Refresher course on Administration & Finance Management for Section Officers, AAOs, AFAOs & Assistants of ICAR HQ & Institutes was held during December 10-14, 2018 at ICAR-NIASM, Baramati which was organized by ICAR-NAARM, Hyderabad. In this training programme, 25 officers and staff from different ICAR institutes participated. Various aspects of administration, finance and office management were deliberated by experts from ICAR HQ and other ICAR institutes.



Refresher Course on Administration & Finance Management

Summer School on 'Climate change and abiotic stress management strategies for doubling farmer's income'

ICAR sponsored summer school, during September 7-17, 2018 were attended by twenty three scientists, teachers and researchers from six states including Tamil Nadu, Telangana, Andhra Pradesh, Karnataka, Madhya Pradesh and Maharashtra. Lectures related to abiotic stress management and doubling farmers income in abiotic stressed areas were delivered and also hands on training on use of equipment related to abiotic stress assessment such as Hyper Spectral Remote Sensing, Plant Phonemic facility, orchard management and gene silencing etc. were demonstrated to the trainees. Various eminent researchers and speakers from various ICAR Institutes and agriculture universities were also delivered lectures on climate change and abiotic stress management.



Summer school programme at ICAR-NIASM

One day Workshop cum Training Programme on 'Scope and Prospects of Organic Farming in Sugarcane Cultivation'

The programme discussed organic sugarcane production technologies, strategies for enhancing productivity and soil health management. The sugarcane experts from KVK Baramati and Central Sugarcane Research Station, MPKV, Padegaon were invited. About 100 sugarcane farmers and ICAR-NIASM staff participated in the workshop.



Advanced training on ‘Detection, identification and application of microbially derived biomolecule for alleviation of salinity stress in crop plants’

Advance training on detection, identification and application of microbially derived biomolecule for alleviation of salinity stress in crop plants was organized at ICAR-NIASM during February 15-28, 2018. This training was supported by Ministry of External Affairs, Govt. of India and Dept. of Agriculture Research and Education, New Delhi under Indo Africa Forum Summit III. Three participants from Nigeria attended this training programme. The objectives of this short course were to get the participants acquainted with the salt affected soils and their remediation using biomolecules in major crop plants. Training included diverse lectures and practical related to soil analysis and isolation and characterization of biomolecules using chromatographic techniques, modus operandi of sophisticated equipment such as UHPLC, LC-MS, GC-MS, ICP-MS, AAS, Nanodrop, Biolog system, PCR. In addition, exposure visits were also conducted at ICAR-NRCG, IISER-Pune, PMKV-Rahuri and KVK-Bhabhleshwar.



Participants of Advanced training on detection, identification and application of microbially derived biomolecules

Advanced training on ‘Application of plant phenomics tools for assessing responses of crop plants to drought and high temperature’

Advance training on application of plant Phenomics tools for assessing responses of crop plants to drought and high temperature was organized at ICAR-NIASM during February 15-28, 2018. This training was supported by Ministry of External Affairs, Govt. of India and Dept. of Agriculture Research and Education, New Delhi under Indo Africa Forum Summit III. Five participants from 3 African countries (2 each from Sudan and Egypt and 1 from Malawi) attended this training programme. The objectives of this short course was to update

the participant about phenotyping and phenomics concepts and tools for abiotic stress tolerance in crop plants and to prepare them as potential contributors for “Crop Phenom Database” for long term strategy to develop stress tolerant cultivars. Training included lectures and practical classes to deliver information and skills on plant phenotyping, image analysis, stress monitoring high throughput phenomics as well as low cost phenomics tool. Participant’s availed opportunity to carry out their experiments in National Plant Phenomics facility at NIASM.



Participants of Advanced Training on Application of Plant Phenomics Tools

Advanced training on ‘Characterization of abiotic stress responses in field and horticultural crops through hyper spectral remote sensing’

Advanced training on characterization of abiotic stress responses in field and horticultural crops through hyper spectral remote sensing was organized at ICAR-NIASM during February 15-28, 2018. This training was supported by Ministry of External Affairs Govt of India and Dept. of Agriculture Research and Education, New Delhi under Indo Africa Forum Summit III. Four participants were attended this training programme. The objectives of training were to make them acquainted with the basic principles of hyper spectral remote sensing and its applications in abiotic stress identification and mapping. Training included lectures and practical classes to deliver information and skills on handling of spectro-radiometer for abiotic stress measurement and its data analysis besides practical on use of drone for stress mapping.



Advanced training on characterization of abiotic stress responses in field and horticultural crops

One day training programme on ‘Protection of Plant varieties and Farmers’ Rights

It is necessary to recognize and protect the rights of the farmers in respect of their contribution made in conserving, improving and making available plant genetic resources for the development of the new plant varieties. Therefore, a one day training programme was organized on “Protection of Plant Varieties and Farmers Rights on December 6, 2017 at ICAR-NIASM. The chief guest in his inaugural address, appealed to the farmers to adopt the research activity adopted by this institute and to increase their agricultural income by making interaction with Scientists NIASM. It was highlighted that the farmers were trying to cultivate traditional crop varieties for long years back. Farmers can protect such plant varieties by registering under the Protection of Plant Varieties and Farmers Rights Act (2001). About 150 farmers and scientists participated in this training and awareness program.



One day Training programme on PPV & FRA and release of compemdiu of training Lectures

Model training course on ‘Climate smart agriculture for enhancing crop and water productivity under abiotic stress conditions’

ICAR-NIASM, Baramati organized 8 days model training course on “Climate smart agriculture for enhancing crop and water productivity under abiotic stress conditions” during December 16-23, 2017, sponsored by Directorate of Extension, Department of Agriculture, Co-operation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Govt. of India. The objective of this programme was to sensitize extension functionaries/officers of state development departments and other participants of ICAR, SAU and KVKs with basic knowledge in the sphere of climate smart agriculture (CSA) based technologies. Their potential applicability for enhancing crop and water productivity by alleviation of abiotic stresses in agriculture. Total 22 participants from the eight states viz., Delhi, Goa, Chhattisgarh, Madhya Pradesh, Maharashtra, Uttar Pradesh, Kerala and Telangana attended the programme. The lectures and practical in the field of climate change, food security and climate smart agriculture, abiotic stresses and their mitigation strategies, horticulture production system, water and soil management technologies; novel microbial, biotechnological and phenomics approaches for enhancing crop and water productivity were delivered by the various experts/resources persons.



Model training on Climate smart agriculture for enhancing crop and water productivity under abiotic stress conditions and Participants of training programme.



Summer School on ‘Recent Advances in Abiotic Stress Management for Climate Smart Agriculture’

Twenty one days Summer School on “Recent Advances in Abiotic Stress Management for Climate Smart Agriculture” was conducted at ICAR-NIASM during 8-28 September, 2017. The objective of the training was to update the scientists of Assistant and Associate Professors rank in the ICAR institutes, SAUs and CUs/DUs about strategies for management of various abiotic stresses in crop plants and animals to meet the challenges of food security. Lectures and practical by experts in the field of agriculture were included. Twenty seven participants from ICAR Institutes and SAU’s comprising ten different states of our country participated in this training programme. During the training programme participants got acquainted with the emerging concepts and approaches for climate smart agriculture and hands on training on various highend equipment like Phenomics, ICPMS, Spectroradiometer, IRGA, UHPLC, AAS, Infrared Camera. Two exposure visits at MPKV, Rahuri and KVK, Baramati were arranged during the training programme.



Summer School on “Recent Advances in Abiotic Stress Management for Climate Smart Agriculture” at ICAR-NIASM, Baramati



Short course on ‘Phenomics: Perspectives for application in improvement of abiotic stress tolerance in crop plants’

A short course on Phenomics: Perspectives for application in improvement of abiotic stress tolerance in crop plants was organized at ICAR-NIASM from 20-29 July, 2017 for scientists working on abiotic stresses in different crops. The training was sponsored by Education Division of ICAR. The objectives of the short course was to update the scientists of ICAR institutes, SAUs and CUs/DUs about ‘phenotyping and phenomics concepts and tools’ for abiotic stress tolerance in crop plants and to prepare the trainees as potential contributors for Crop Phenome Database critical for long term strategy to develop stress tolerant cultivars. Training included lectures and practical classes to deliver information and skills on plant phenotyping, image analysis, stress monitoring high throughput phenomics, low cost phenomics tool. More than 20 lectures were delivered in the area of phenotyping and abiotic stress research by expert from the institute. In addition, there were six online lectures delivered by experts in phenomics from CIMMYT, Mexico, Plant Accelerator, Australia, John Innes Centre, UK and CSIRO, Australia.



Short-term training on “Phenomics: Perspectives for application in improvement of abiotic stress tolerance in crop plants” at ICAR-NIASM, Baramati

Two days workshop on ‘Challenges and Opportunities in Sugarcane Cultivation under Changing Climatic Scenario’

The Workshop discussed the need and opportunities for collective efforts of all the stakeholders (scientists, farmers, policy makers, sugar industrialists, etc.) to tackle challenges like poor sugar recovery, lower cane and water productivity, deterioration of soil health, increasing production cost and to bring dynamism in the sugar industry. The experts shared their knowledge with the progressive farmers so as to sensitize about the developments and latest happenings in the research on sugarcane and guiding the sugarcane growers to adopt and spread the recent technology in the field of sugarcane production, soil management, farm mechanization and sugarcane based industries. On-going field experiments at ICAR-NIASM were also demonstrated. The workshop was attended by more than 350 progressive farmers from various Tehsils of Pune. Officers from state line departments and KVK, Baramati, representatives from nearby sugar factories and various government and private organizations and staff of ICAR-NIASM were also present. This workshop was sponsored by the NABARD, Pune; The Malegaon Sahakari Sakhar Karkhana Ltd., Malegaon; Shree Someshwar Sahakari Sakhar Karkhana Ltd.; Someshwar, Shri Chhatrapati Cooperative Sugar Factory Ltd.; Bhawaninagar, Zuari Agro Chemicals Ltd. Pune; United Phosphorus Ltd., Mumbai and Jain Irrigations Systems Ltd., Jalgaon.



Goat Farming Training Camp at Krantisinh Nana Patil College of Veterinary Science, Shirval Satara

ICAR-National Institute of Abiotic Stress Management, Malegaon, Baramati conducted training programmes in collaboration with Krantisinh Nana Patil Veterinary College, Shirval

for the tribal farmers of Nandurbar district at Shirval under Tribal Sub Plan (TSP) of Government of India. Four Such training programs of three days duration each were conducted between 6th to 25th March 2017, Tribal Farmers were imparted with skill and knowledge of goat rearing techniques, management, feeding, breeding and disease management, insurance, bank loans etc. during training. Besides on hand training, field visits were also arranged for the farmers.



Training on 'ICAR-ERP (MIS & FMS)'

A training programme was organized at ICAR-NIASM, Baramati during the period 19-24 January, 2017 to resolve some operational issues regarding ERP. A total number of 18 representatives from 5 different ICAR institutes of the western zone participated in the aforesaid training which was also attended by this host institute's staff. The above said 5 institutes are NRC-Grapes, DOGR and DFR of Pune, NRC-Pomegranate of Solapur and ICAR-CIRCOT of Mumbai. The programme covered various topics under four major modules namely "Payroll and Finance", "Supply Chain Management (SCM)", "Human Resource Management System (HRMS)" and "Project Management". Among other things the programme dealt with functionalities like employee transfer, employee self-service, leave balance adjustment, payroll posting to general ledger (GL), account receivable (include receipts), asset capitalization, general ledger (including journal entries), budget uploading, purchase requisition, auto create, applying tax on purchase order, receipt creation against a purchase order, item inspection/delivery, RPP creation for scientific projects and project budget entering.



Outreach Activities of the Institute

Tribal Sub-Plan

After 25 years of independence, and successful completion of four five year and three annual plan, it was realized by policy makers that the Scheduled Tribes are still very behind the mainstream development process and the general plan schemes and programmes designed for the overall development of the economy hardly improved their socio-economic status. Similarly, the benefit of such general welfare schemes did not percolate down towards the development of the STs population of the country in significant manner. In order to address these issues, the Tribal Sub-Plan was initiated during Fifth Five Year Plan for the socio-economic amelioration of the tribal communities.

ICAR-NIASM conducted various activities under Tribal Sub-Plan in three Tehsils/Talukas viz. Navapur, Nandurbar and Dhadgaon from the designated Nandurbar district of Maharashtra during 2012 to 2018. Considering poor education status and socio-economic limitations of tribals, various villages of three different Talukas of the Nandurbar district were selected. Based on the overall agro-ecological situation and requirements of tribal farmers, implementation of improved technology interventions in integrated field crops, horticultural crops, livestock's, fisheries was conceptualized for improving their livelihood and sincere efforts were made to encourage these activities to provide supplementary incomes to small and marginal farmers and landless labours/farmers from these major subsidiary occupations.

Following four strategies were adopted for improving the tribal farming system:

- Baseline survey of a large number of villages of three different talukas of Nandurbar district for assessment of existing farming system, abiotic and biotic stresses and selection of villages and farmers.
- Input support/introduction of suitable high yielding varieties/animals breeds/fish species.
- Implementation of improved technology interventions in Integrated Crop-Livestock-Poultry-Fisheries for livelihood improvement of tribal farmers.
- Organisation of capacity building programmes such as trainings, field day, on farm demonstrations, exposure visits and the use of local news media for popularization.

Significant contributions has been made by TSP implementation team of multi-disciplinary scientists of ICAR-NIASM in implementation of improved technology interventions in field crops (rice, sugarcane and wheat), horticultural crops (banana, dragon fruit, okra, chilli, onion), dairy farming (fodder, deworming, mineral mixture and Mehsana buffalo), Osmanabadi goat unit (4 female + 1 male), backyard poultry (Vanaraja and Giriraja birds with cage and feed) farming, IMC aquaculture, culture based reservoir fisheries and integrated farming through innovative extension methodologies, immensely benefitting the farming community in 60 villages of three different talukas of Nandurbar district. Farm implements, certified planting materials of high yielding improved varieties, four point rice production technology and plantation of *Gliricidia* as live fences, green leaf manure and animal forage, water efficient crop production technology in sugarcane, adoption of micro-irrigation techniques, integrated nutrient, pest and disease management, agricultural soil health assessment based fertilizers recommendations, kitchen gardening of dragon fruit, commercial vegetable and fruit cultivation, dual purpose chicks along with poultry cages,

disease resistant animal breeds, suitable fish species, and proper soil and water quality management have been promoted among tribal farmers. By integration of field and horticultural crops, fish and animal components, net farm income of 7339 tribal farmers increased by minimum 44% even in climate change prone selected areas.

Implementation of improved technological interventions in different commodities.

Sub-project	Objectives	Activities
Improved technology interventions in field crops	Improved technology interventions in rice	<ul style="list-style-type: none"> • Participatory demonstration of “Four point rice production technology” on farmers’ field. • Yield performance of rice variety Indrayani and Phule Samridhi. • Organization of farmers field day and training programmes on four point rice production technology. • Promoting plantation of <i>Gliricidia</i> as live fences, and green leaf manure for crop production and animal forage.
	Improved technology interventions in sugarcane	<ul style="list-style-type: none"> • Participatory demonstration of Water efficient crop production technology in sugarcane. • Organization of farmer’s field day and training programmes on Sugarcane crop. • Resource use efficiency (Micro-irrigation and Nutrient use efficiency) demonstrations.
	Improved technology interventions in wheat	Improved technology interventions in wheat
Improved technology interventions in horticultural crops	Improved technology interventions in banana	<ul style="list-style-type: none"> • Virus free tissue culture banana cultivation. • Water use efficiency in virus free tissue culture cultivar and suckers.
	Improved technology interventions in onion	<ul style="list-style-type: none"> • Proper nursery raising and transplanting management in high yielding and long storage varieties of <i>Rabi</i> and late <i>kharif</i> onion
	Improved technology interventions in dragon fruit	<ul style="list-style-type: none"> • Distribution of dragon fruit cuttings/saplings for kitchen gardening / Backyard farming
Improved technology interventions in livestock and poultry	Improved technology interventions in dairy	<ul style="list-style-type: none"> • Introduction of high yielding improved breeds of milch buffalos. • Nutritional management in livestock for livelihood improvement of tribal farmers. • Deworming and mineral mixture supplementation. • Training about balanced nutrition, parasitic diseases of livestock and its management.

Sub-project	Objectives	Activities
		<ul style="list-style-type: none"> • Organization of exposure visits / trainings at advanced dairy units / farms/ Surveys for milk production and availability of marketable surplus. • Raising high yielding fodder crop on tribal farmers' fields. • Formation of dairy farmers group. • Facilitation for cattle breeding and animal health services.
	Improved technology interventions in goatery	<ul style="list-style-type: none"> • Training programmes for imparting skill and knowledge of goat rearing techniques, management, feeding, breeding and disease management, insurance, bank loans etc. • Exposure visits. • Distribution of goat units of 4 females and one male to 44 tribal farmers.
	Improved technology interventions in backyard poultry	<ul style="list-style-type: none"> • Group meetings with tribal farmers on "Backyard Poultry Farming". • Training about parasitic diseases and nutritional requirements of poultry and its management. • Distribution of 300 units of 20 Vanraja/Giriraja/Satpura chicks along with cage, feeder waterer and feed.
Improved technology interventions in fisheries and aquaculture	Improved technology interventions in IMC aquaculture and reservoir fisheries	<ul style="list-style-type: none"> • Demonstration of Farm pond preparation. • Distribution and stocking of IMC seeds. • Training of tribal farmers on Nutritional management in fisheries, fish and prawn farming and their management. • Method for fish feed formulation and preparation. • Organization of farmer's field day on fish culture. • On farm demonstration of measurement of water quality parameters. • Culture based fisheries/stock enhancement of small water bodies.
Improved technology interventions in integrated farming	Improved technology interventions in field & horticulture crops, livestock, poultry and fisheries	<ul style="list-style-type: none"> • Integrated Crop-Livestock-Fisheries. • Integrated Livestock cum Fish farming. • Integrated Goat cum Fish farming. • Integrated agri-aquaculture. • Integrated dairy cum fish farming. • Integrated poultry cum fish farming.



Mera Gaon Mera Gaurav (MGMG)

An innovative initiative “Mera Gaon Mera Gaurav” (MGMG) was planned to promote the interaction of scientists with the farmers to hasten the lab to land process. The objective of MGMG is to provide farmers with required information, knowledge and advisories on regular basis by adopting villages. The participation of small and marginal farmers in Indian agriculture is very important. Small farmers put forth their desire on various forums to have timely information on investment in agriculture, loans, availability of other basic amenities, market rates, extension activities and facilities provided by different agencies, new research findings and technologies, etc.

The MGMG teams identified the general problems namely, water scarcity, roads, animal disease, marketing of agricultural goods, irrigation, soil quality and, information on newer technologies. Issues regarding agriculture were scanty rainfall, drought, water salinity, non-availability of water storage tank, subsidy for water storage tank, sugarcane trash burning, higher tiller mortality and lower cane yields of sugarcane ratoon and excess and imbalanced use of fertilizer, problem soils, poor drainage, soil sodicity and salinity, quality

seed availability, frequent and intermittent drought, post-harvest and storage of farm produce, nutrient deficiencies. The visits were made under Mera Gaon Mera Gaurav program in all identified villages i.e., Khor, Kusegaon, Roti, Hinganigada, Diksal, Sonkaswadi, Kanadwadi, Waky, Jalkewadi, Sanghavi, Kambaleshwar, Pandare, Pavanewadi, Manapawadi, Belwandi, Rakshaswadi, Baradgaon dagdi, Lakdi, Nimbodi, Shindewadi, Bori and Kazad. Frequent interaction and demonstrations were conducted during visit and about 1393 farmers were involved and got benefited. Various awareness programmes were organized and farmers were made aware through literature support in Marathi about Pradhan Mantri Fasal Bima Yojna, Soil Health Card Scheme, dragon fruit an alternative option for water scarce areas, pomegranate management during drought period, shinghi breeding, poultry and cattle management. Proper linkages were developed with State Agriculture Department, KVK Baramati, NGOs, Nathson Farmer Producer Company, Department of Animal Husbandry, Local Revenue department and Taluka Agriculture Officer. MGMG teams created awareness in farmers regarding diversification of crops i.e., dragon fruit and drumstick under water scarcity areas; Jalyukta Shivar scheme of Government of Maharashtra; Conservation agriculture for enhancing resource-use efficiency and environmental quality; avoidance of sugarcane trash/crop residue burning; integrated farming system involving horticulture crops, livestock, poultry and fisheries for livelihood security; vaccination in livestock; integrated nutrient management; organic farming; soil test based nutrient application; pond preparation for in situ water conservation; pest and disease management; micro-irrigation strategies for efficient water management; fish seed production and management; post-harvest quality management and Marketing. To promote Dragon fruit crop one day training program-cum exposure visit was organized in 2016-17 at ICAR-NIASM in which 118 farmers from 23 villages got benefitted.



Director, ICAR-NIASM interacting with farmers of MGMG adopted villages, exposure visit of dragon fruit for water scarce areas, Farmers' field day and Farmer's meet

Team	Name of scientists with discipline	Name of village
Team 1	Dr. Jagdish Rane, Head-SDSM Dr. DD Nangare, Senior Scientist Dr. Sunyan Saha, Scientist Mr. V Rajagopal, Scientist Ms. Sravanthi Bandela, Scientist	Jalgaon KP, Bhilarwadi, Dhakale, Mudhale, Loni- Bhapkar
Team 2	Dr. KK Krishnani, Head-SESM Dr. KK Meena, Senior Scientist Dr. RL Choudhary, Scientist Dr. SS. Pawar, Scientist Mr. Paritosh Kumar, Scientist	Sanghavi, Kambaleshwar, Pandare, Pavanewadi and Manapawadi
Team 4	Dr. SK Bal, I/c, Head-SASM Dr. Y Singh, Senior Scientist Dr. B Sajjanar, Scientist Mr. Rajkumar, Scientist	Sonkaswadi, Kanadwadi, Waky, Kamgalwadi
Team 5	Dr. NP Kurade, Principal Scientist Dr. AL Kamble, Scientist Dr. RL Meena, Scientist Mr. A Balusamy, Scientist	Pimplawadi, Kopardi, Rakshaswadi Bk., Belwandi, Baradgaon Dagadi
Team 6	Dr. DP Patel, Principal Scientist Dr. GC Wakchaure, Scientist Dr. Mahesh Kumar, Scientist Dr. Neeraj Kumar, Scientist	Nimbodi, Lakadi, Shindewadi, Kazad and Bori
Team 7	Dr. MP Brahmane, Principal Scientist Dr. Ajay K Singh, Senior Scientist Mr. GopalaKrishnan B. Mr. Prashant Kumar, Scientist	Kusegaon, Hinganigada, Roti, Diskal, Khor

Activities carried out during 2016 in the selected villages (Institute/SAU wise)

Visit to village		Goshthis/ Interface meetings conducted		Demonstrations conducted
No. of visits	No. of farmers	No. of Goshthis/ interface meetings	No. of farmers	Title of demonstration
6	100	6	100	<ul style="list-style-type: none"> Create awareness among the farmers regarding various agricultural schemes viz., PM crop insurance scheme, PM Krushi Sinchan Yojna, soil health card scheme. Onsite demonstration of various water saving technologies (including dragon fruit cultivation), planting methods for establishment of orchards in shallow rocky land, and other institutional activities to farmers during visit to institute. Suggested diversification of crops <ul style="list-style-type: none"> i. Dragon fruit (low water requirement, medicinal use and high market value crop) ii. Drumstick variety:PKM-1 for better yield

Linkages created with Other departments/ agencies (furnish name)	Problem diagnosed		Awareness created	
	General problem	Agriculture problem	Subject matter	No. of farmers
19	20	21	22	23
Agriculture department, Maharashtra state and KVK, Baramati, NGOs	Water scarcity	Less rainfall, saline water, Requirement of water storage tank and subsidy for water storage tank	Suggested diversification of crops i.e., dragon fruit and drumstick under less water condition Jalyukta Shivar scheme of Govt. of Maharashtra.	More than 100

Name of activities	No. of farmers
<ul style="list-style-type: none"> Organized the training for farmers on 'Promotion of dragon fruit cultivation as kitchen gardening in semi-arid region of Maharashtra' from selected MGMG villages 	113
<ul style="list-style-type: none"> During KRISHIK Exhibition at KVK Baramati 19-22 January 2017, awareness created among the farmers (More than 1000 farmers) about new crop: Dragon fruit cultivation. 	>1000
<ul style="list-style-type: none"> Dr D D Nangare, Scientist invited by KVK Jalna on 5.3.2017 to deliver lecture on 'Dragon fruit cultivation and management'. Created awareness among the farmers nearby Jalna and Aurnagabad areas about new crop i.e Dragon fruit cultivation. The farmers asked about the availability of planting material at our institute. 	>200
<ul style="list-style-type: none"> Dr D D Nangare, Dr Yogeshwar Singh and Dr Manoj Brahmne visited Savantvadi village, Taluka: Baramati and guided and aware farmers with latest technologies. 	>15

Activities during 2017-18 under MGMG

Activities & Sub-activities				Beneficiaries (No.)
Villages covered	Visits made	Demonstrations	Farmers meeting	
Kambleshwar	1	Demonstration of importance of pheromone traps and light traps in Chick pea pest management	Dr Rajkumar, Scientist (Agricultural Entomology) delivered lecture on IPM in Chick Pea in farmer's meeting.	50
Andhori, Karadwadi and Waghoshi Bhadvade	2	Scientists visited farmer's field and have seen vegetable plots of Chiili, Bhendi, Bitter guard and fruit crop pomegranate and tuti plantation in three villages. Also, visited Water storage tanks	<ul style="list-style-type: none"> Participated in Krishi Mela Scientists of NIASM delivered lectures in Krishi mela held at Bhadvade, Waghoshi, 	80

Activities & Sub-activities				Beneficiaries (No.)
Villages covered	Visits made	Demonstrations	Farmers meeting	
		and dairy unit		
Waghoshi, Bhadawade, Kanheri, Shaikhmirwadi villages in Khadala tehsil Dist. Satara and farmers from other nearby villages in Khandala Tehsil	1	Demonstration of Dragon fruit and other horticulture crops grown in shallow basaltic soil and animal unit, cereal crops research plots at Institute level.	Farmers got the information of the new technologies viz. dragon fruit cultivation, planting methods in shallow basaltic soil etc. during field visit	70
Farmers in nearby villages of Institute in Baramati, Daund, Indapur and khandala tehsil	2	Demonstration of the technologies at Institute level. Farmers visited the institute	Farmers participated in Sugarcane workshop, IPR workshop and visited the experimental /demonstration plots of ICAR-NIASM and got the information of the new technologies viz. Dragon fruit cultivation, Planting methods in shallow basaltic soil etc.	More than 200 farmers
Jalgaon (KP)	1	-	Meeting conducted to create awareness among farmers about importance of soil testing, animal health and value addition of cereal and horticulture crops at village Jalgaon (KP).	20
Dhakale	1	-	Farmers meeting in village to invite a group of farmers from the selected villages to ICAR-NIASM for onsite demonstration of various water saving technologies (including dragon fruit cultivation), planting methods for establishment of orchards in shallow rocky land, and to show other institutional activities.	10
Visited Three villages 1. Andhori 2. Karadwadi 3. Waghoshi Tehsil :	1	Scientists visited farmer's field of vegetable plots of Chili, Bhendi, Bitter guard and fruit crop pomegranate and tuti plantation in	<ul style="list-style-type: none"> • Krishi Mela at Village:Waghoshi Tehsil : Khadala on 24.3.2018 • Lectures delivered by Scientists of NIASM • Dr Nitin Kurade talked on 	80

Activities & Sub-activities				Beneficiaries (No.)
Villages covered	Visits made	Demonstrations	Farmers meeting	
Khandala Dist: Satara		three villages. Also, visited Water storage tanks and dairy unit. Scientists suggested water management practices to improve the productivity of crops.	<p>‘सुधारित पशुपालन तंत्रज्ञान’,</p> <ul style="list-style-type: none"> • Dr Manoj Brahmne talked on ‘मत्स्य पालन बाबत विविध संधी’, • Dr D D Nangare talked on ‘ड्रॅगन फळ लागवड’. • Dr GC Wakchaure talked on ‘भाजीपाला लागवड तंत्रज्ञान, Dr Bhaskar Gaikwad talked on ‘कृषि यांत्रिकीकरण’ • Dr Mukesh Bhendarkar talked on ‘मत्स्य पालन कसे करावे’. 	

Visit of farmers from Khandala Tehsil to ICAR-NIASM, Baramati

Seventy farmers from Khadala Tehsil visited to ICAR-NIASM, Baramati on November 19, 2017. They were shown the experimental orchards in north side, crops in south side, Animal and fishery unit were informed about the technology and research going in the Institute.



Krishi Mela at Village-Waghoshi, Taluka- Khadala, Dist.- Satara

The scientists visited the farmer's field at Andhori, Karadvadi villages and other fields including one farm pond on the way to Waghoshi village on 24.3.2018. The visit was made to the various fields of vegetable cultivation with chili, bitter guard, bhendi, tuti plants and pomegranate orchards. In chili, the problem mostly observed is of leaf curling and suggested

micro nutrient sprays. For other remedies told them to contact vegetable expert at MPKV, Rahuri. In Tuti plantations, farmers are facing the marketing problem as there is no policy of Govt of Maharashtra for procurement of silk. One farmer's group in village Karadvadi visited Bangluru market to sale their silk. But they are getting lower rates as compared to local farmers in Karnataka state. Lastly, at Waghoshi village, the scientists participated in Krishi Mela. Earlier there was no irrigation facility in Waghoshi and nearby villages. Now, the canal has been constructed and the farmers are getting the irrigation to crops through canal. To make the farmers, in canal command, aware about the new available technologies, the scientist of NIASM gave their talk in the respective field.



ABOUT THE LOGO

The three symbolically interlocking radial hands represent (a) the cyclic anthropogenic pressures of livestock (blue), agriculture (green) and fisheries and other water related activities (aquamarine blue) and (b) human of various creeds and colours, under taking for livelihoods on the land scape which needs consideration not in a sectional approach but a holistic way to provide customized technologies and (c) asking for forging unrelenting extensive linkages of peers through global co-operation to pact against our surmountable problem by collective action, thus generating new material represented by emerging seedling in the centre.

Raindrop in the centre indicates the driving force of life but is threatened by (a) stresses of climate change and (b) associated various anthropogenic actions reflected by symbolic hands around.

The clouds crossing raindrop are (a) like Asian Brown Clouds indicative of looming climate change (b) from greenhouse effects or pollution which needs undeviating attention.

The central triangular open space created by hands around the raindrop institutionalizes creation of unique facility under single umbrella with growth for (a) specially focused high quality research facilities embedding frontier sciences, and (b) choicest capacity building through a cutting-edge education.



The seedling in green colour connecting earth with raindrop expresses the efforts of the scientists to tackle all the pressures through screening and developing through biotechnology or other futuristic tools to evolve abiotic stress tolerant and or adoptable plants, animals, fishes etc. and the undying optimism towards ever regenerating life regardless of forever mounting pressures of human beings.

Black color text राअस्ट्रैप्रसं represents the name of the institute in Hindi 'राष्ट्रीय अजैविक स्ट्रेस प्रबंधन संस्थान'. **NIASM** is acronym for 'National Institute of Abiotic Stress Management'.

The brown colour surface supporting seedling represents earth is the endangered 'nature' consequential to (a) unabated land degradation resulting in edaphic stresses like drought, floods, salinity, soil acidity pollution etc. due to the forces of varying rainfall confounded by the plaguing climate change and (b) a shrinking greenery by deforestation related activities needing attention of all dwellers of 'spaceship earth' on resource conservation.



ICAR-NATIONAL INSTITUTE OF ABIOTIC STRESS MANAGEMENT
(Indian Council of Agricultural Research)
Malegaon, Baramati, Pune – 413 115
Maharashtra, India
URL: <http://www.niam.res.in/>

