October
2020

Project Coordinator

.... a monthly update

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

Project Coordinator
.... a monthly update

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From Director's Desk .....

Greetings from ICAR-NIASM...!!

The current issue on project coordinator comprises the outputs of October, 2020 and targets for November, 2020 under different ICAR-NIASM projects. Besides harvesting of *Kharif* crops and planning for *rabi* experiments, data collection and analysis, a team of our scientists visited and surveyed in the nearby villages of Baramati to assess impact of heavy rainfall and flood on agriculture occurred during October 11-15, 2020. The assessment report has been published on the Institute website for wider dissemination. In addition, a technical bulletin on Dragon fruit comprising its cultivation practices, post harvest management, nutritional and economic evaluation conducted at ICAR-NIASM experimental farm has been published which will be useful for researchers, farmers and other stakeholders. An international webinar on "Translating physiology into techniques for abiotic stress tolerance in crops' was organized in collaboration with the Indian Society for Plant Physiology and Society for Agricultural Research on Abiotic Stresses with an aim to explore status, constraints and opportunities in this area of research for young scholars and scientists. The webinar provided an opportunity to almost 500 participants to listen to the experts from different disciplines from India and abroad which included scientists, entrepreneurs and students.

Contents

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The 'Insights from global research' section is encompassing information on improving field applicability of *Trichoderma harzenium* while preserving its efficacy. 'A leaf from history' features role of salicylic acid towards salinity tolerance in plants. I sincerely hope that this issue will help the scientists and the farm personnel of NIASM and other research Institutes for better coordination among project staff while implementing the planned activities. I thank Dr. Aliza Pradhan and team for their dedication and sincerity in bringing out this publication and wish that the issue would be received well by readers across all domains.

(Himanshu Pathak)

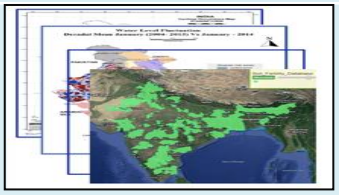
"If conservation of natural resources goes wrong, nothing else will go right".

- Prof. M. S. Swaminathan

UP 1. Abiotic Stress Information System (ASIS):

Geo-spatial digital maps of multiple abiotic stresses, management options and future scenarios

PI: Bhaskar B Gaikwad; **Co-PI(s):** Amresh Choudhary, Ram N Singh, Dhananjay D Nangare, Nitin P Kurade, Sachinkumar S Pawar, Mukeshkumar P Bhendarkar, Madhukar L Gubbala, Sunil V Potekar, Pravin H More



Concept of ASIS

Outputs

- Review of data sources of weather and soil related datasets.
- Pre-processing of data on livestock census, major water reservoirs of India.

Targets for next month

- Technical draft on methodology for geospatial stress mapping.
- Selection of YP II for the project.

UP 2. Germplasm Conservation and Management (GCM):

Genetic garden and gene bank for abiotic stress tolerant plants, animals and fisheries for food security and sustainability

PI: Boraiah K M; **Co-PI(s):** Ajay K Singh, Basavaraj, P S, Mahesh Kumar, Satish Kumar, Rajkumar, N Karthikeyan, Paritosh Kumar, Sanjeev K Kochewad, Mukesh kumar P Bhendarkar, Jagadish Rane, Neeraj Kulakshetran, Pravin B Taware, Aniket More, Rushikesh Gophane, Lalitkumar Aher

Salinity tolerant Turmeric genotypes

Outputs

- Processing for purchase of required research materials/consumables.
- Compilation of information for technical bulletin on varieties/genetic stocks tolerant to different Abiotic Stresses.
- Received activities from Dr. Neeraj Kulakshetran, Principal Scientist and Head of crop improvement division, ICAR-CSSRI, Karnal which will be submitted to competent authority for approval.

Targets for next month

- Planning and sowing of abiotic stress tolerant genetic stocks, wild relatives, varieties of wheat, chickpea and vegetable crops.
- Compiling and finalizing activities of new Co-PIs.
- Morphological Characterization of salinity tolerant turmeric genotypes.

UP 3. Model Green Farm (MGF):

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

PI: Dhananjay D Nangare; **Co-PI(s):** Himanshu Pathak , Goraksha C Wackchaure, Bhaskar B Gaikwad, Vanita Salunkhe, Rajkumar, Paritosh Kumar, Aliza Pradhan, Amresh Chaudhary, Mukesh kumar P Bhendarkar, Sangram B Chavan, Vijaysinha D Kakade, Pratapsingh S Khapte, Pravin B Taware, Rushikesh Gophane, Noshin Shaikh, Santosh Pawar, Avinash V Nirmale

Digging of compost pit

Outputs

- Layouts for sandal wood plantation, digging of pits are ongoing; completion of procurement of sandal wood seedlings.
- Isolation and purifying of the pathogenic fungi from dragon fruit.
- Collection of the fruit weight, fruit diameter, fruit pulp and peel weight data; maximum fruit yield was under mixed soil followed by black and native soil.
- LIS and installation of automation system work is ongoing.
- Irrigation and maintenance of medicinal garden.
- Publication of technical bulletin on "Dragon fruit: A potential crop for abiotic stressed areas".

Targets for next month

- Monitoring the progress of automation system installation in the field.
- Planting of sandalwood seedlings.
- Recording of growth observations of tamarind trees.
- Soil sampling.
- Monitoring of diseases in dragon fruit; simultaneous isolation and purification of pathogenic fungi associated with it.
- Survey of dragon fruit plots on farmer's field.
- Monitoring irrigation in orchards and medicinal garden.

UP 4. Climate-smart IFS (CIFS):

Climate resilient integrated farming system in semi-arid region

PI: Sanjiv A Kochewad; **Co-PI(s):** Kamlesh K Meena, Goraksha C Wackchaure, Vanita Salunkhe, Rajkumar, Mukeshkumar P Bhendarkar, Aliza Pradhan, Amresh Chaudhary, N Subash, Laxman R Meena, Pravin B Taware, Patwaru Chahande

Preparation of layout for planting of Acid lime and Papaya in multi-tier farming

Outputs

- Planning and layout of multi-tier farming and collection of quotations for construction of multi-tier farming structure is in process.
- Completion of planting of Acid lime and papaya.
- Completion of procurement of materials required for installation of drip irrigation in multilayer farming plot.
- Finalization of crop varieties for rabi season; procurement of seeds and fertilizers is in process.
- Procurement and laying of geo-membrane HDPE sheet in fish pond is in process.

Targets next month

- Procurement and laying of geo-membrane HDPE sheet in fish pond.
- Field preparation and procurement of seeds and fertilizers for Rabi season.
- Construction of structure and laying of drip irrigation in multilayer farming in IFS model.
- Planting of agroforestry tree species on boundary.
- Preparation and application of Dashparni ark for groundnut leaf spot management.

FP 1. Atmospheric Stress Management:

Adaptation and mitigation of atmospheric stress in crops, livestock, poultry and fishes for sustainable productivity and profitability

PI: Nitin P Kurade; **Co-PI(s):** Manoj P Brahmane, Sachinkumar S Pawar, Sanjiv A Kochewad, Bhaskar B Gaikwad, Rajkumar, Mukeshkumar P Bhendarkar, Ram N Singh, Dhananjay D Nangre, Avinash V Nirmale, Sunil V Potekar

Preparation of mixed silage of maize and Napier grass

Outputs

- Recording of comparative status of anaemia and physiological parameters *viz.* body temperature, heart rate and respiratory rate in different breeds of goat.
- No significant activity of Fruit fly in dragon fruit through pheromone and sticky traps.
- Preparation of mixed silage of maize and napier grass for its evaluation during scarcity period.
- Generation of district wise monthly temperature trend maps of MH.
- Rainfall data collection of IMD stations.

Targets next month

- Evaluation of stress parameters and parasitic prevalence in different breeds of goat.
- Initiation of trial on ecofriendly IPM module for managing fall armyworm in maize.
- Collection and analysis of Meteorological data of MH.
- Stocking management, acclimatization and conditioning of fish seed and Post-stocking management of ponds.
- Development of Live fish feed culture unit.

FP 2. New Crops:

Augmenting farm income in water scarce regions with alternative crops

PI: Jagadish Rane ;**Co-PI(s):** Ajay K Singh, Dhananjay D Nangre, Goraksha C Wackchaure, Mahesh Kumar, Satish Kumar, Karthikeyan N, Boraiah K M, Sanjiv A Kochewad, Aliza Pradhan, Amresh Chaudhary, Ram N Singh, Basavraj P

Quinoa

Outputs

- Field requisitions for native soil and black soil and planning layout for quinoa experiment for *Rabi* 2020-21.

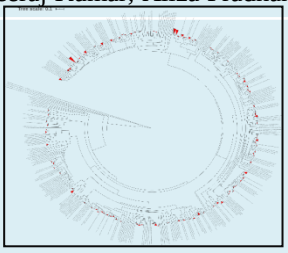
Targets for next month

- Preparation of technical bulletin on underutilized crops in India.

FP 3. Bio-saline Agriculture:

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

PI: Kamlesh K Meena; **Co- PI(s):** Satish Kumar, Ajay K Singh, Vanita Salunkhe, Sanjiv A Kochewad, Mahesh Kumar, Paritosh Kumar, Neeraj Kumar, Aliza Pradhan, Amresh Chaudhary, Himanshu Pathak



Culturable bacteria associated with halophytes

Outputs

- Literature compilation underway to formulate a comprehensive review article on halophytes and their agro-ecological significance on a global scale.

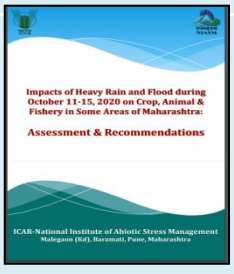
Targets for next month

- Preparation of technical bulletin on the halophytes and associated microbiome for ameliorating the saline soil of semi-arid region of the country.
- To explore naturally occurring halophytes in nearby areas of Baramati.

FP 4. Technology Targeting and Policy:

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

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



Impact assessment Report

Outputs

- Two fortnightly agro advisories published on the Institute's website for stakeholders (English & Marathi versions).
- Impact assessment report due to heavy rain and flood during October 11-15, 2020 on crop, animal and fishery in Maharashtra.

Targets for next month

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

A) School of Atmospheric Stress Management (SASM)

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

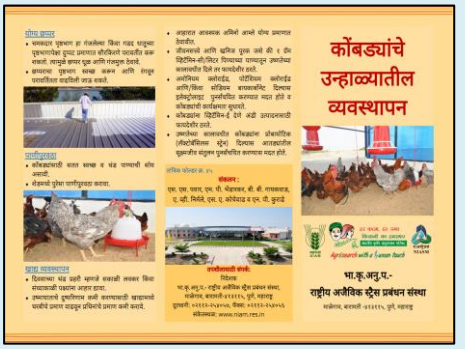
PI: Sachinkumar S. Pawar; **Co-PI:** Nitin P Kurade

Outputs

- Collection of environmental parameters to access stress levels in poultry birds and assessment of thermal stress risks.
- Publication of technical folder entitled "कोंबड्यांचे उन्हाव्यातील व्यवस्थापन".

Targets next month

- Recording of environmental parameters to access stress levels in poultry.
- Procurement of experimental birds.

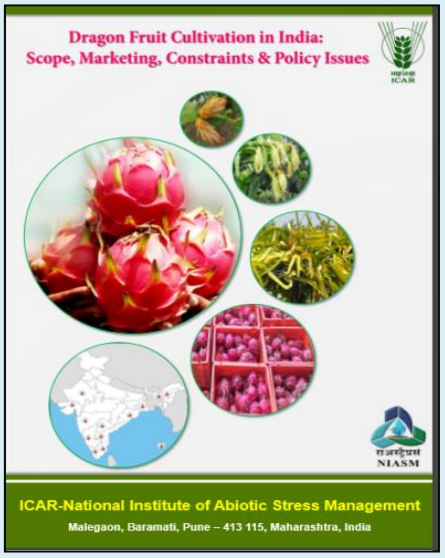


Technical Folder on "कोंबड्यांचे उन्हाळ्यातील व्यवस्थापन"

B) School of Water Stress Management (SWSM)

1. Mitigating water stress effects in vegetable and orchard crops

PI: Goraksha C Wackchaure; **Co -PI(s):** Dhananjay D Nangare, Satish Kumar, Aliza Pradhan, K M Boraiah, Karthikeyan N, Jagadish Rane



Technical Bulletin

Outputs

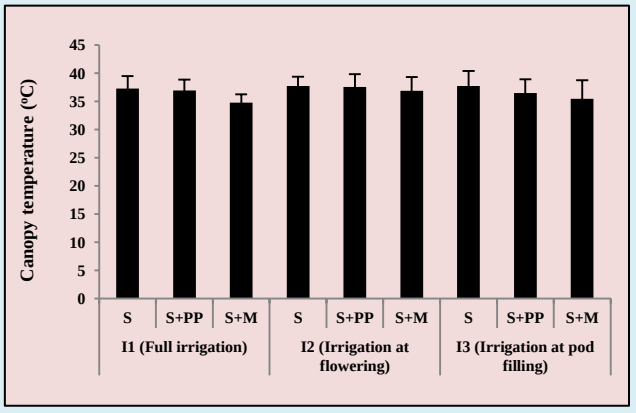
- Preparation of bulletin entitled 'Dragon Fruit Cultivation in India: Scope, Marketing, Constraints and Policy Issues'.
- The bulletin covers various aspects of dragon fruit cultivation including scope, production status and market trade at national and global level.
- The bulletin also informs about potential areas of cultivation, cultural and post-harvest management practices, farmer's constraints, majors researchable and policy issues with detailed SWOT analysis for India.
- The available information complied in this bulletin about dragon fruit is useful for guiding policy makers, state agricultural departments, KVK, SAUs, private entrepreneurs, consultants and students etc.

Targets for next month

- To study the storage behaviour of dragon fruits under different temperatures conditions.
- Nursery preparation, planning and layout of the field experiment on onion using line source sprinkler system.

2. Exploring cropping system approaches for enhanced water productivity and income: Evaluating performance of soybean based cropping systems in response to deficit irrigation

PI: Aliza Pradhan; **Co-PI(s):** Jagadish Rane, Amresh Chaudhary, Karthikeyan N



Effect of cropping system on soybean canopy temperature (^{0} C)

Outputs

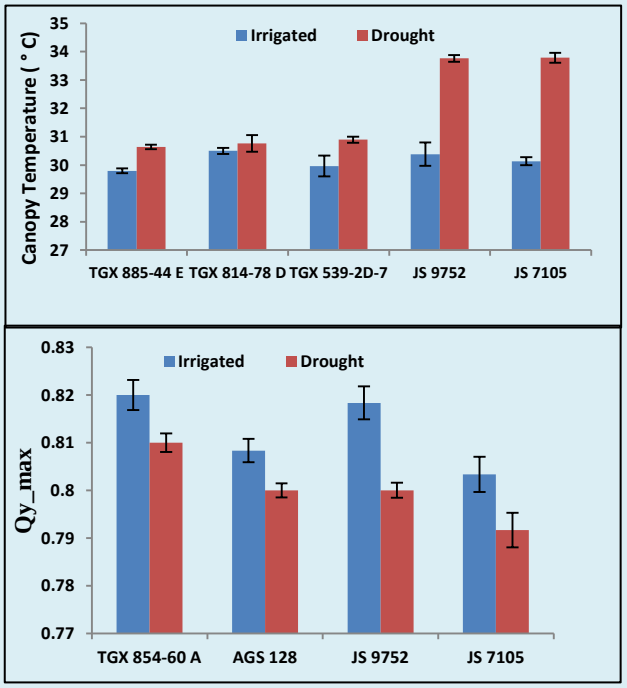
- Data collection and analysis of canopy temperature, crop growth rate, nodule no and weight, shoot : root at pod filling stage of soybean.
- Canopy temperature: Soybean + maize < soybean + Pigeon pea < Sole Soybean.

Targets next month

- Harvesting and collection of yield attributing parameters and yield in soybean and maize.

EAP 1. Genomics strategies for improvement of yield and seed composition traits under drought stress conditions in soybean (Funded by: ICAR-NASF)

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



Canopy temperature and PS-II efficiency of soybean genotypes

Outputs

- Soybean genotypes evaluated for traits such as canopy temperature depression, canopy greenness and photosystem –II efficiency associated with drought tolerance.
- Soybean genotypes- TGX 814-78D showed cooler canopy and canopy greenness as compared to JS9752 and JS-7108 under drought and irrigated conditions. Soybean genotype-TGX854-60A had higher PS-II efficiency than JS-9752 and JS-7108 under drought and irrigated conditions.

Targets for next month

- Evaluation of 50 soybean germplasms along with check varieties in Greenhouse for drought adaptive traits such as canopy temperature, PS-II efficiency, NDVI value, and water status (RWC).
- Evaluation of 50 soybean germplasms along with check varieties in greenhouse for traits associated with water logging tolerance.
- Plant DNA isolation from 50 soybean germplasm for GWAS studies through NGS to identify genes associated with drought and waterlogging tolerance.

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

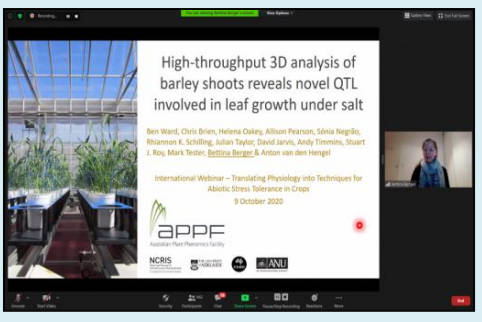
PI: Jagadish Rane; **Co-PI:** Mahesh Kumar

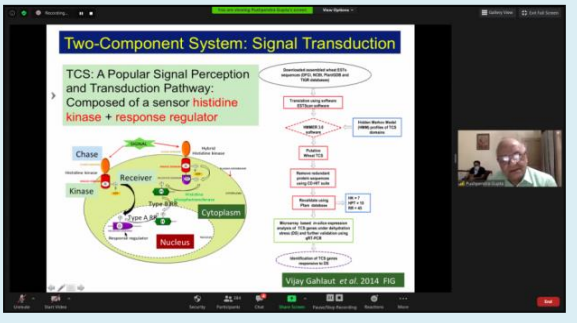
Outputs

- Initiation of experiment with chickpea genotype (24) to characterise under depleting soil moisture condition using IR, VIS and NIR sensors.
- Recording response of chickpea genotypes using different physio and biochemical parameters.
- International webinar on “Translating physiology into techniques for abiotic stress tolerance in crops”, held on October 09, 2020.

Targets for next month

- Phenotypic evaluation of chickpea genotype using phenomics.





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

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

Experiment of Rice genotypes

Outputs

- Experiment reinitiated to understand the varietal role in rice weed competition.
- Preliminary observations indicated Hybrid rice (6444), CR Dhan 303 and Goa-Dhan 1 was less affected by weeds compared to others.

Targets for next month

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

EAP 4. Evaluation of halotolerant rhizobium and PGPB based biomolecules for alleviation of drought and salt stress (Funded by: AMAAS, NBAIM, Mau)

PI: Kamlesh K. Meena; **Co-PI(s):** Goraksha C Wackchaure, Satish Kumar

An overview of the wheat crop under the influence of microbial consortium and varying exogenous N, P and K regimes.

Outputs

- Analysis of the two-year field trial data on impact of microbial consortium on wheat.
- Yield analysis concluded that the microbial consortium can significantly reduce the cultivation cost of wheat.
- Further, the use of microbial consortium also has been found useful to lower the requirements of exogenously supplied N, P, and K inputs.

Targets for next month

- To analyse the field-soil data post inoculation with microbial consortium in wheat under varying exogenously added N, P, and K conditions.

EAP 5. Conservation Agriculture for Enhancing Resource-Use Efficiency, Environmental Quality and Productivity of Sugarcane Cropping System (Funded by: CA Platform ICAR)

PI: Kamlesh K. Meena **Co-PI(s):** Goraksha C Wakchaure, Mahesh Kumar, Paritosh Kumar, Amresh Choudhary, Aliza Pradhan, Himanshu Pathak

Outputs

- Sugarcane planting material (var. 86032) was procured and was transplanted on field according to the layout-plan of the treatments for the *Farmers' Practice* regime.
- Management and fertigation were performed as per the treatment schedule.
- Growth parameters were recorded from all the treatments.

Targets for next month

- Timely measurement of growth and physiological attributes of sugarcane from all the treatments.
- Installation of sub-surface drip (SSD) irrigation system at the experimental plot reserved for planting system experiment.

Transplanting of sugarcane

EAP 6. Abiotic stress detection from field to landscape scale in different crops using remote sensing tools (Funded by ISRO -SAC)

PI: Jagadish Rane; **Co-PI:** Ram N Singh

Wheat cultivars under various soil moisture conditions

Outputs

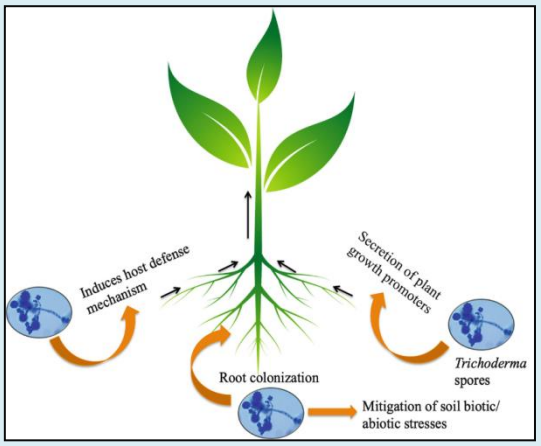
- In situ crop specific signatures of wheat cultivars under various soil moisture conditions.
- Evaluation of photosynthetic efficiency of wheat cultivars.
- Monitoring the response of wheat cultivars under irrigated and water deficit conditions using IR imaging.

Targets for next month

- In situ crop specific signatures of Sugarcane. And In situ spectral signatures of soil.
- Evaluation of photosynthetic efficiency of Sugarcane.

Improving Field Applicability of *Trichoderma harzianum* while preserving its efficacy

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



Non-target effects of *Trichoderma* on plant and soil (Jangir et al., 2019)

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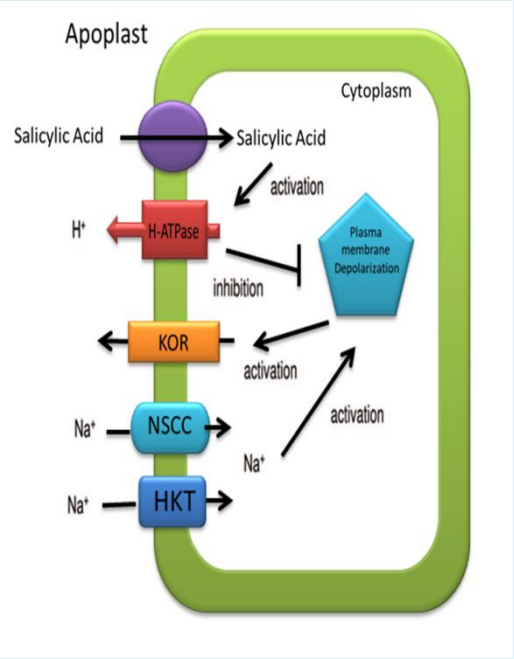
Use of *Trichoderma harzianum* as a biological control agent against phytopathogens as well as in mitigation of various abiotic stresses like salinity, waterlogging and nutrition deficiencies is very well documented (Jangir et al. 2019). However, when it is applied directly in field, its efficacy gets affected by biotic and abiotic factors. Joos et al. 2020 tested composts as carrier mediums to improve its applicability, while preserving its effectiveness against diseases. The population dynamic of *T. harzianum* was studied in three composts differing in biological characteristics based on the Nematode Index of Compost Maturity (NICM). The results showed a decline in the *T. harzianum* population, which became stable after six or eight weeks, irrespective of compost, concentration or sterilization. It was concluded that the compost is a suitable carrier medium for *T. harzianum*. Serna-Díaz et al., 2020 evaluated the conidiospores production of *T. harzianum* using barley straw as substrate. Four growth conditions were used; washed and unwashed barley straw and washed and unwashed barley straw supplemented with mineral salts. The highest spore production was observed when washed barley straw supplemented with mineral salts. While studying the effect of substrate moisture on spore production, it was observed that a humidity of 80 % of the substrate improves the production of conidiospores. Conidiospores viability was evaluated for 12 months by keeping them on the conidia and substrate, and viability of 71 % was observed, so this maintenance method is an excellent means of conserving the conidiospores viability. Maruyama et al., 2020 tried microencapsulation with polymeric microparticles to maximize the efficacy of *T. harzianum*. Photostability assays showed that encapsulation protected the fungus against ultraviolet radiation. The *T. harzianum* encapsulation showed an improvement in the chitinolytic and cellulosic activity. It can be inferred from this brief review that use of biological agents through substrates like composts and straw at field level will improve its applicability while preserving its efficacy. Encapsulated formulations of these agents will be a ready to use tool for farmers.

A leaf from history: Salicylic Acid-A mitigating tool for salinity stress tolerance in plants

Krishna Kumar Jangid, Research Associate, ICAR-NICRA Project



Schematic diagram representing the valuable effects of salicylic acid to cytosolic K+ homeostasis in plant roots

In this era of climate change, abiotic stresses has been accepted as the biggest factor for affecting the agricultural productivity all over the world. Plant are affected by variouse environmental factor such as water, salinity, temperature, light, nutrient, ozone, UV-B radiation etc and reduced their yield potential. In the effect of these abiotic stresses all physiological, biochemical, and molecular processes in plants negatively influence. Various plant growth regulator such as salicylic acid and other which involved in growth and regulation process of plant have indicated their response against the mitigation of abiotic and biotic stress. Salicylic acid (SA) is an active phenolic compound of signaling networks aginst the biotic and abiotic stress response. Salinity stress tolerance mechanism also activated by salicylic acid with enhancing chlorophyll content and antioxidant enzyme activity (Li et al., 2014). During salt tolerance responce SA develop antioxidant defence mechanism by acclimatizing the activities of antioxidant enzymes, increase accumulation of soluble carbohydrates, increase ATP content, and maintain optimum K^+/Na^+ ratio under saline conditions (Hayat et al., 2010). SA in involve in inflection of ion transport processes (e.g. Na+, K+, and H+ fluxes) in plant during salt stress. The cellural level of K+ decreases significantly under salinity stress and it attended by addition of Na+ inside the cell (Jayakannan et al., 2013). Thus the replacement of K+ in metabolic reactions started damaging normal enzymatic activity and metabolism and finally cell death occure Exogenouse application of SA stimulated plasma-membrane depolarization and inhibited K+ uptake (Glass, 1974). Hence, Salicylic acid have significant role in K+ dynamics in the mitigation of salt stress.

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- Jayakannan, M., Bose, J., Babourina, O., Rengel, Z., & Shabala, S. (2013). Salicylic acid improves salinity tolerance in Arabidopsis by restoring membrane potential and preventing salt-induced K+ loss via a GORK channel. Journal of Experimental Botany, 64(8), 2255-2268.

"Agriculture is a fundamental source of national prosperity".

-J. J. Mapes