February
2021

Project Coordinator

.... a monthly update

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

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From Director's Desk .....

Greetings from ICAR-NIASM !!!

The current issue on project coordinator highlights the progress made under all the ICAR-NIASM projects during February, 2021 and targets for March, 2021. Last month, the institute organized a panel discussion of NIASM-NAAS pune chapter on 'Abiotic Stress Management in Maharashtra Agriculture' on 20th February, 2021. The discussion focused on the impact of abiotic stress on agriculture, livestock, horticulture, fisheries and floriculture in Maharashtra State, their mitigation strategies and policy recommendation for abiotic stress research. The institute also celebrated its 13th Foundation day on 21st February, 2021 where the achievements of NIASM during 2020 and also the research, academic and outreach activities of NIASM planned for next year, were highlighted. On the occasion, two Memorandum of Understanding (MoU's) were signed and exchanged between ICAR-NIASM and Agriculture Tourism Development Trust (ATDC), Pune and Shivnagar Vidya Prasarak Mandal, Malegaon, Baramati for collaboration in area of Agro-Tourism and academics & research, respectively. In addition, research and development efforts were made regarding development of thermal stress severity assessment tool for livestock, selection and selfing of mutant plants of chia and quinoa, investigation of salt tolerance potential of newly isolated bacterial strains, development of ATIC & screening of rice, wheat & chick pea genotypes. I thank Dr. Aliza Pradhan and her team for their dedication and sincerity in bringing out this publication and wish that the issue would be received well by readers across all domains.

(Himanshu Pathak)

Contents

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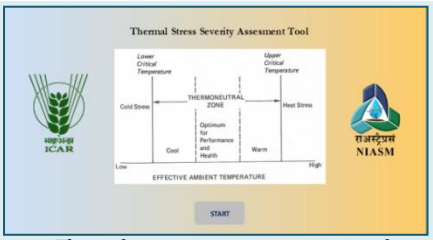
Celebration of 13th Foundation Day of ICAR-NIASM on 21st Feb, 2021

UP 1. Abiotic Stress Information System (ASIS)

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

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



Thermal stress severity assessment tool

Outputs

- Spreadsheet model "Thermal Stress Severity Assessment Tool For Livestock".
- The Thermal Severity was assessed based on five days forecasted values of selected geo-location.

Targets for next month

- Webapp for Suggest management options based on Forecasted values and 10 year historic data of the selected geo-location.

UP 2. Germplasm Conservation and Management (GCM)

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

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

Maintenance of 14 brinjal wild species

Outputs

- Communication with ICRISAT for genetic resources of crops such as pigeonpea, foxtail millet, finger millet and groundnut.
- Technical bulletin on abiotic stress tolerant crop varieties, livestock breeds and fish species.
- Imposition of water stress to the wild brinjal species for morpho-physiological characterization.
- Recording of morpho-phyiological observations in turmeric.

Targets for next month

- Maintenance of seed registry of abiotic stress tolerant crop in gene bank.
- Harvesting of turmeric, wheat, chickpea and fenugreek varieties.

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

Setting up of methyl eugenol para-pheromone in mango

Outputs

- Setting up of methyl eugenol para-pheromone traps in mango orchard.
- Survey of farmers growing dragon fruit in their fields.
- Assigning nodal person for each orchard in north block.
- Performance of *in vitro* pathogenicity study in *Colletotrichum spp*. in dragon fruit.

Targets for next month

- Installation of drip system in sandalwood plants.
- Evaluate effect of input type & stocking density on sediment & nutrient accumulation in water in farm pond.
- Collect and compile the initial information of each fruit crops/plots in the north block..
- Molecular characterization of prominent fungal pathogens affecting dragon fruit cultivation.
- Monitoring the progress of work & testing of automation system in the field; dragon fruit farmers survey.
- Setting up of methyl eugenol para-pheromone traps in mango for monitoring and management of fruit flies.

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

Intercultivation of lucerne in pomegranate orchard

Outputs

- Completion of solar pump installation.
- Intercultivation of lucerne fodder crop in pomegranate orchard.
- Hoeing and weeding in *rabi* sown crops.
- First draft of technical bulletin on CIFS.

Targets next month

- Harvesting of pigeon pea, chick pea, sorghum.
- Renovation of goat shed, extension of cattle shed
- Erection of trellis in multilayer farming system.
- Designing a plan for efficient water utilization.

FP 1. Atmospheric Stress Management

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

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

Mass culturing of black soldier fly

Outputs

- Recording of comparative status of growth, physio-biochemical parameters and reproduction in different breeds of goat for winter.
- Collection of environmental parameters to access stress levels in goats and poultry birds and assessment of thermal stress risks for February.
- Recording of data on comparative infestation in different treatment groups in the experiment on IPM of fall armyworm in maize.
- Recording of growth parameters in different salinity levels in GIFT tilapia.
- Collection of black soldier fly larvae for its mass multiplication.
- Collection and compilation of meteorological data.
- Temperature trend of Maharashtra in relation to sugarcane productivity.

Targets for next month

- Evaluation of stress parameters and parasitic prevalence in different breeds of goat.
- Amplification of Heat Shock Protein polymorphic region for poultry.
- Survey on fall armyworm in maize and collection of black soldier fly larvae.
- Collection and analysis of Meteorological data of MH.
- Impact of salinity stress in GIFT Tilapia; development of live fish feed culture unit.

FP 2. New Crops

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 S, Harisha C B

Selection and selfing in mutant plants of chia

Outputs

- Completion of hybridization in chia.
- Screening of chia and quinoa accessions for seedling stage salinity tolerance.
- Selection of mutants in chia and quinoa.
- Morphological characterization of quinoa accessions.
- Technical bulletin on alternative crops.

Targets for next month

- Harvesting of quinoa and chia mutants.
- Photo-thermo insensitivity studies in chia.

FP 3. Bio-saline Agriculture

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

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

Halotolerant bacterial strains showing phosphate production potential

Outputs

- Investigation of salt tolerance potential of newly isolated bacterial strains in 0-20% NaCl conc.
- Investigation of plant growth promoting capabilities of the newly isolated starins in terms of exopolysaccharides production, nitrogen fixation, siderophore production and phosphate solubilization.

Targets for next month

- To investigate the IAA production ability of the newly isolated bacterial strains.
- To measure the growth response of halotolerant bacterial strains under high NaCl regime.

FP 4. Technology targeting and policy

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

PI: Dhananjay D Nangare, **Co- PI(s):** Sachinkumar S Pawar, Sanjiv A Kochewad, Bhaskar B Gaikwad, Boraiha K M, Kartikeyan N, Rajkumar, Mukeshkumar P Bhendarkar, K Ravi Kumar, Himanshu Pathak

Bicycle distribution to SC beneficiaries

Outputs

- Collection of review of literature on available information on ITKs by online and offline mode.
- Preparation of questionnaire/interview schedule for data collection.
- Visit the farmers and trainees of input suppliers to ATIC and farm.
- Distribution of the bicycle and bamboos to SC beneficiaries.
- Organising foundation day programme and activities .
- Publication of two fortnightly agro advisories.
- MOU of NIASM with Mr Pandurang Taware, Agro tourism.

Targets for next month

- Preparation of questionnaire for data collection on abiotic stress management of crops.
- Development of ATIC will continue.
- Collection of the information on ITKs related to abiotic stress.
- Fish rearing in different small farm ponds.
- Preparation of action plan under agro tourism.

A) School of Atmospheric Stress Management (SASM)

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

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

Outputs

- Environmental parameters to access stress levels in poultry birds collected and assessed thermal stress risks in poultry for February month.
- lecture in online International training course on "Biotechnological Approaches in Animal Research and Disease Diagnosis" organized by Guru Angad Dev Veterinary and Animal Sciences University (GADVASU), Ludhiana, Punjab.
- Three days e-training programme entitled "Basic and applied bioinformatics in Animal Sciences" from February 09-11, 2021 organized by Bioinformatics Centre of ICAR-Indian Veterinary Research Institute, Izatnagar.

Vanaraja poultry breed reared under deep litter system

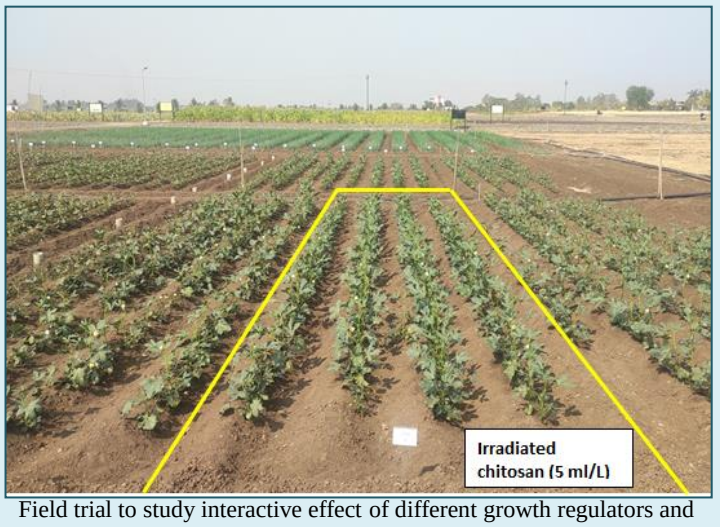
Targets next month

- Collection of blood samples from experimental Vanaraja birds.
- Amplification of Heat Shock Protein-70 polymorphic region in Vanaraja poultry birds.
- Recording of environmental , physiological & haematological parameters to access stress levels in poultry.

B) School of Water Stress Management (SWSM)

1. Mitigating water stress effects in vegetable and orchard crops

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



Field trial to study interactive effect of different growth regulators and water stress in okra

Outputs

- Measurement of real time growth atrributes of onion (cv. Bhima Kiran) to study interactive effect of sulphur and water stress using LSS.
- Measurement of real time soil-water-crop atrributes to study interactive effect of growth regulators on okra (cv. Singham) for alleviating water stress. and water sources.
- Application of foliar sparys of thiourea, salicylic acid, biopolymer, irradiated chitosan, sea weed extract at flowering stage of okra.

Targets for next month

- Foliar application of plant growth regulators (PGR) at fruiting stage and measurement of real time water, soil and crop yield parameters in field experiment of onion (cv. Bhima Kiran) and okra (cv. Singham).

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

Harvesting of Sunflower

Outputs

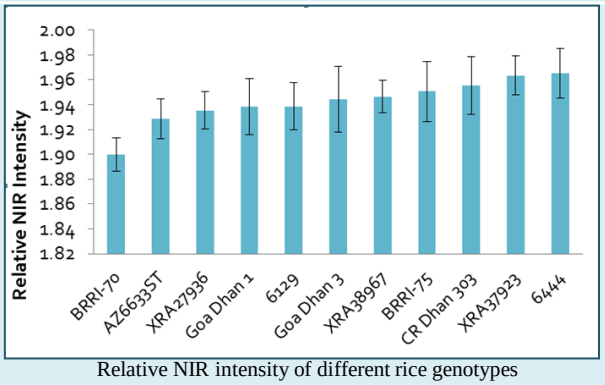
• Recording of real time growth parameters for sunflower (head weight, head diameter, no. of seeds per head, 1000 seed weight).

Targets next month

• Harvesting of sunflower.
• Data analysis and soil sampling.

EAP 1. Climate smart management practices (Funded by: IRRI)

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



Relative NIR intensity of different rice genotypes

Outputs

- Optimization of method to quantify effect of weed on tissue moisture content.
- The method will be helpful in identifying rice genotypes with better tissue moisture content that possibly help in competing with weed.

Targets for next month

- Identification of rice genotype with better Fe response under DSR.

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

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

Outputs

- Field characterization of chick pea genotypes (175) for drought and heat tolerance in two soil types.
- Image based tools to study the variability in chick pea for physiological and morphological traits.

Targets for next month

- Field characterization of chick pea genotypes for drought and heat tolerance.

Phenotyping of chick pea genotypes

EAP 3. Conservation agriculture for enhancing resource-use efficiency, environmental quality and productivity of sugarcane cropping system (Funded by: CA Platform ICAR)

PI: Goraksha C Wakchaure **Co-PI(s):** Aliza Pradhan, Amresh Chaudhary, Paritosh Kumar, Himanshu Pathak

Measurement of yield attributes in sugarcane

Outputs

- Data Recording of real time growth parameters and irrigation for tillage and planting system in sugarcane.
- Measurement of yield, yield attributes and post-harvest quality parameters of sugarcane in tillage and planting system.

Targets for next month

- Recording of real time growth attributes of sugarcane.
- Layout and installation of drip system in sugarcane cropping system.

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

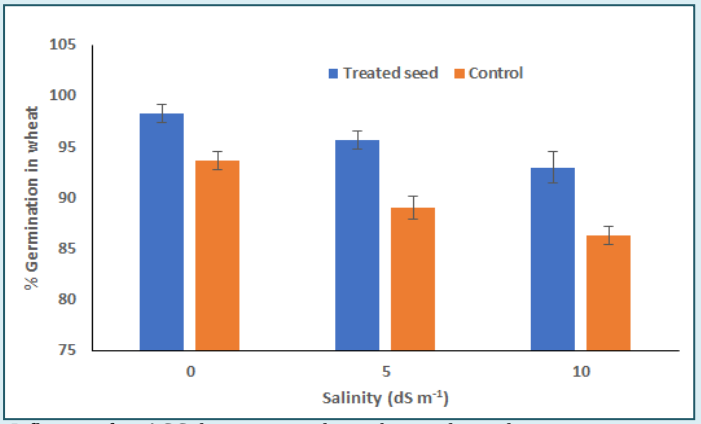
PI: Satish Kumar; **Co-PI:** Goraksha C Wackchaure

Outputs

- Evaluation of the impact of ACC deaminase producing bacterial inoculation on salinity tolerance of wheat.
- Production of biopolymer for field application.

Targets for next month

- To investigate the impact of an ACC deaminase producing bacterial strain on biochemical status of wheat seedlings in terms of antioxidant enzymes activity.
- To determine the influence of microbial inoculation on localization of OH- and O. radicals in salinity stressed wheat seedlings.



Influence of an ACC deaminase producing bacterial inoculation on germination of wheat under saline conditions

Foliar Spraying Strategies for Alleviation of Abiotic Stress Effects in Mango

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

Mango production faces several challenges, due to water stress, soil salinity, micronutrients deficiency and problems related to fruit yield and quality. The deleterious effect of high temperatures associated with low air relative humidity and water depth reduction causes high abiotic stress levels and consequently lower rates of photosynthesis, transpiration and leaf water potential. Under such conditions field practices such as foliar spray of agrochemicals, organic bio-stimulants and micronutrients can help to alleviate the adverse effects of these stresses.

Elsheery et al. (2020) assessed the effect of nanoparticles (NPs) like nano-zinc oxide (nZnO) and nano-silicon (nSi) on mango tree growth, yield, and fruit quality under salinity conditions. Trees positively responded to different levels of nZnO and nSi. Plant growth, nutrients uptake, and carbon assimilation have improved with all treatments. Flower malformation was significantly decreased, and the annual fruit yield and physiochemical characteristics improved with all treatments. They recommended that a combination of 100 mg/L nZnO and 150 mg/L nSi improves mango tree resistance, annual crop load, and fruit quality under salinity conditions. Doaa and Shalan (2020) investigated the effect of Sodium Silicate Pentahydrate (Si) and Glycine betaine (GB) on enhancing salt tolerance of Mango seedlings grown under salinity stress. Combinations of Si and GB sprays was the most effective treatment in alleviating the negative impacts of salt stress in mango, this treatment increased significantly most of the tested parameters under salt stress.

El-Hoseiny et al. (2020) evaluated the effect of applications of humic acid (as potassium humate; 0.15%, 0.30%, 0.45%) and boron (as boric acid; 300, 600 mg·LL1) on mango trees. Humic acid and boron effectively enhanced tree growth, flowering, yield, and fruit quality. Combined application of both, surpassed the single application of each material on overall tree physiology and annual productivity. They discussed that it may be a consequence of the increase in tree photosynthetic pigments, nutrients, organic solutes, and phytohormones such as auxins, gibberellins, and cytokinins. The reduction in abscisic acid content may be related to the role of humic acid and boron protecting the plant against destructive oxidative reactions; improving the ability of the trees to withstand environmental stresses; thereby reduce floral malformation percentage, minimize the incidence of alternate bearing, and improve annual tree productivity and fruit quality. Maklad et al. (2020) investigated the efficacy of calcium, zinc and boron foliar application individually or in combinations at different times and concentrations on flowering, yield and fruit quality. They recommended that spraying calcium, zinc and boron combination at 2.5ml/L four times is the best treatment for increasing yield and fruit quality.

da Silva et al. 2020 noted that the shoot maturation phase is important for growing mango tree because it precedes the floral induction, when plants are under stress caused by high temperatures and low water availability, that could be reduced by using plant bio-stimulant. The use of a plant bio-stimulant containing yeast extract and amino acids to alleviate abiotic stress in mango plants grown in semiarid environment. The variables evaluated were: i) leaf concentrations of soluble carbohydrates, starch, amino acids and proline; and ii) enzymatic activity of catalase and ascorbate peroxidase. The foliar spray with bio-stimulant during the branch maturation phase of mango trees grown in tropical semiarid environment alleviated plant abiotic stress. Three foliar bio-stimulant sprays and one K2SO4 spray are recommended to alleviate mango plant abiotic stress in semiarid environment.

Mango tree at flowering and fruit set stage

Reference:

Elsheery NI, Helaly MN, El-Hoseiny HM, Alam-Eldein SM 2020 Zinc Oxide and Silicone Nanoparticles to Improve the Resistance Mechanism and Annual Productivity of Salt-Stressed Mango Trees. Agron. 10, 558, doi:10.3390/agronomy10040558.

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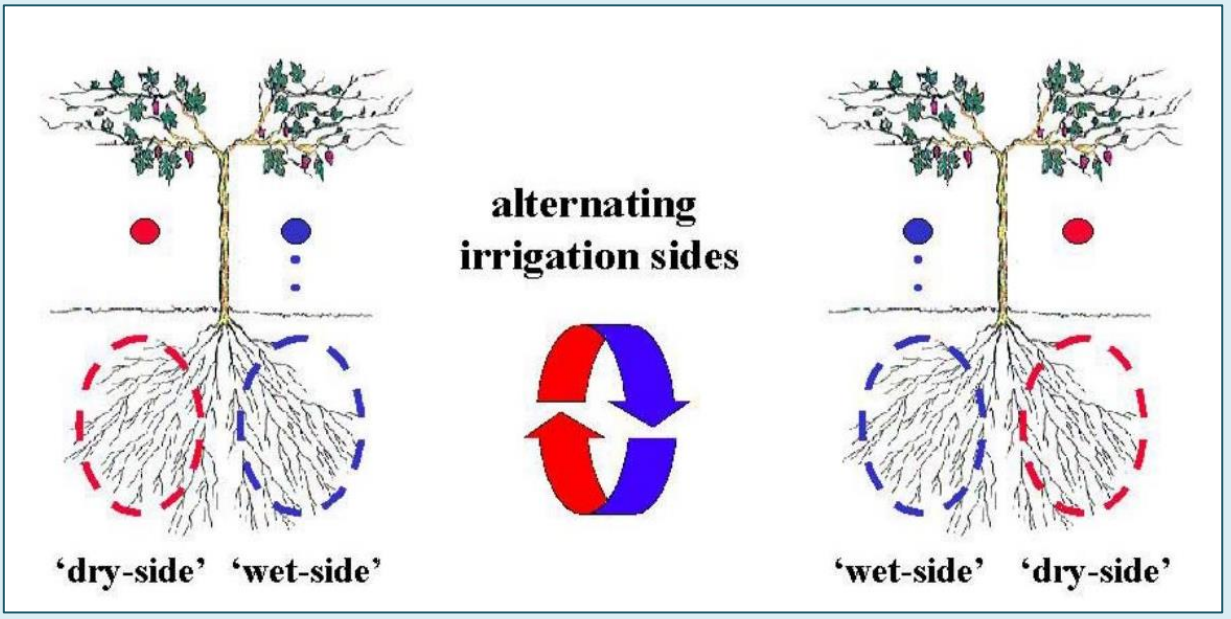
da Silva MA, Cavalcante IHL, Mudo LED, de Paiva Neto VB, e-Amariz RA, da Cunha JG 2020 Bio-stimulant alleviates abiotic stress of mango grown in semiarid environment. R. Bras. Eng. Agríc. Ambiental, 24(7), 457-464, doi: 10.1590/1807-1929/agriambi.v24n7p457-464.

A leaf from History: Partial root zone drying technique in fruit crops

- Sunil V Potekar, Senior Technical Assistant (Agrometeorology)

Partial root-zone drying (PRD) is a modified form of deficit irrigation (DI) in which half of the root zone is irrigated alternatively in scheduled irrigation events. This system purposefully imposes water stress to the plants at specific growth stages by providing limited amounts of plant's daily water use. The production of ABA hormone and other chemical signals in the drying roots presumably reduces stomatal conductance and leaf growth (Gowing et al. 1990) thereby increasing water use efficiency.

Practical results showed that crops under PRD yielded better than under DI when the same amount of water is applied. This resulted in higher water productivity (WP) and even better fruit quality (Shahnazari et al., 2007). In mango orchards where water is a limiting factor, PRD may be the key for a sustainable production (Spreer et al. 2007). Stoll et al., (2000), also observed increased sugar content in grapes with PRD and this was attributed to better control of vegetative growth. Further in wine grape, the quality parameters of fructose and tannins were improved significantly with PRD (Fang et al., 2013). Papaya can tolerate certain water deficit without substantial yield reduction. A 30% water deficit induced through PRD water supply technique did not significantly affect vegetative growth and yield components as compared to full irrigation. Lima et al. (2015) confirmed that PRD technique improved papaya WUE through lower stomatal conductance without affecting the photosynthesis and growth characteristics. Thus, a shift to these irrigation methods should help in substantial savings in irrigation water.



Implementation of partial root-zone drying

Reference(s)

Behboudian MH, Mills TM (1997) Deficit irrigation in deciduous orchards. Hortic Rev 21:105–131.

Fang, Y.L, Sun, W., Wan, L., Xi, Z.M., Liu X. and Zhang, Z.W. (2013). Effects of regulated deficit irrigation (RDI) on wine grape growth and fruit quality. Scientia AgriculturaSinica, 46: 2730– 2738.

Gowing DJG, Davies WJ, Jobes HG (1990) A positive root sourced signal as an indicator of soil drying in apple, malus x domestica-Borkh. J Exp Bot 41:1535–1540

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"Biodiversity is the greatest treasure we have…its diminishment is to be prevented at all cost".
-Thomas Eisner