



# अजैविक स्ट्रेस प्रबंधन समाचार Abiotic Stress Management News

भाकृअनुप-राष्ट्रीय अजैविक स्ट्रेस प्रबंधन संस्थान  
(समतुल्य विश्वविद्यालय)

मालेगाँव खुर्द, बारामती - 413 115, पुणे, महाराष्ट्र, भारत

ICAR- National Institute of Abiotic Stress Management  
(Deemed to be University)

Malegaon Kh., Baramati - 413 115, Pune, Maharashtra, India



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### Major Events

- Inauguration of 11/0.433 KV Electrical Substation
- Inauguration of Krishna Residency' (Type III & IV Quarter) at MIDC, Baramati
- Swachh Bharat Abhiyan
- National Fish Farmer Day celebrated at ICAR-National Institute of Abiotic Stress Management, Baramati
- ICAR-National Institute of Abiotic Stress Management (ICAR-NIASM), Malegaon, Baramati organized one-day workshop on "climate smart technologies for sugarcane cultivation
- 73<sup>rd</sup> Independence Days Celebration
- MoU with Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola
- हिन्दी कार्यशाला

### Workshop/Seminar/Symposia/Conference/ Training attended

### Publications

### Personalia

- Awards/Recognition

### Editorial Committee

Dr. Ajay Kumar Singh  
Dr. Mahesh Kumar  
Dr. Neeraj Kumar  
Mr Harisha CB  
Dr Paritosh Kumar

### Technical Assistance

Madhukar Gubbala  
Pravin More

## From the Director's Desk.....

### Greetings from ICAR-NIASM.

As evident from the recent IPCC report there should not be any complacency in dealing with global climate change. Appropriate measures are essential to reduce the chances of global ambient temperature increasing by 1.5°C by the end of the century. It is a proven fact that reducing the carbon emission and trapping it for productive purpose are possible options to check the global warming. Both these options are integral components of agriculture and forestry. Keeping the barren lands covered by vegetation comprising of crops and forest species is a feasible. In addition to crisis management, it is essential to prepare for risk management through scientific interventions for climate resilient agriculture system to meet the food demand. This can be achieved through incorporation of traits and features essential to withstand vagaries of extreme weather, which are likely to be amplified in terms of magnitude and frequency by climate change. In this context, relevant research project to manage abiotic stresses in agriculture have been initiated at NIASM.



Possibility of converting a basaltic barren land into a land suitable for field and horticultural crops has been successfully demonstrated by NIASM. On the other hand, optimized production technology for climate resilient crops like dragon fruit can contribute to enhanced income of farmers of marginal and drought prone land. Scaled up machine for intercultural operations in trash ridden ratoon sugarcane can serve as boon for farmer to preserve soil organic carbon. Optimization of technologies for large scale characterization of responses of crop plants can help incorporating climate resilience in crops. Potential of beneficial microbes to alleviated abiotic stresses have been realized in several experiments carried out by NIASM scientists with microbial products and consortium. Recently established medicinal plant block can set another example of an avenue to trap atmospheric CO<sub>2</sub> with optimum use of water. Significant results have been obtained from experiments conducted to explore nano-technological interventions to manage fish nutrition in integrated farming system. Thus NIASM's present initiative carry high potential to cater to the need of managing agriculture under expected abiotic stress scenarios of climate change. At present scientists and students from national and international institutes is making use of facilities at NIASM to accomplish the task. NIASM believes in complementing research and academic activities at institutes and Universities sharing common interest in abiotic stress management.

The institute has taken several important steps for human resource development of farmers by conducting workshops on fish farmers on the occasion of fish farmers days and another workshop on climate smart technologies for sugarcane cultivation. Apart from research, institute also have very important role in SCSP programmes and Swachh Bharat Mission and etc. I thank the editorial team who made tremendous efforts to compile the highlights of the institute in this issue of the Newsletter.

I also thank to all the staff members who have contributed for this issue of Newsletter. I extend my sincere thanks to Dr Trilochan Mohapatra, Secretary (DARE) & Director General (ICAR); Shri Sushil Kumar, Additional Secretary (DARE) & Secretary (ICAR); Shri B. Pradhan, Additional Secretary & Financial Advisor (DARE/ICAR); Dr. K. Alagusundaram, DDG, NRM (ICAR); Dr. S. K. Chaudhari, ADG, Soil & Water Management and Dr. S. Bhaskar, ADG, AAF & CC for their continued support to ICAR-NIASM. I am very much confident that this issue of the Newsletter would provide useful information for advancement of research on abiotic stress management to readers across different domains.

Date : September 30, 2019

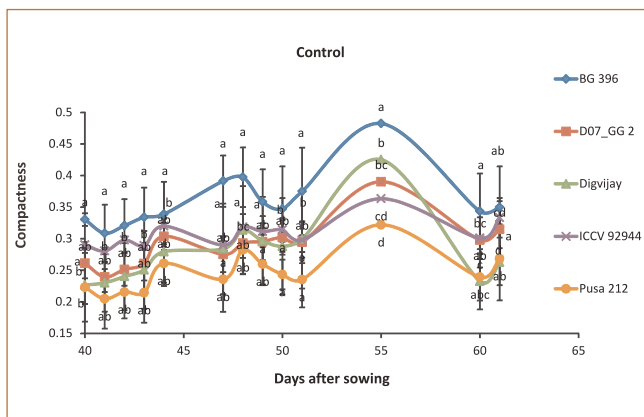
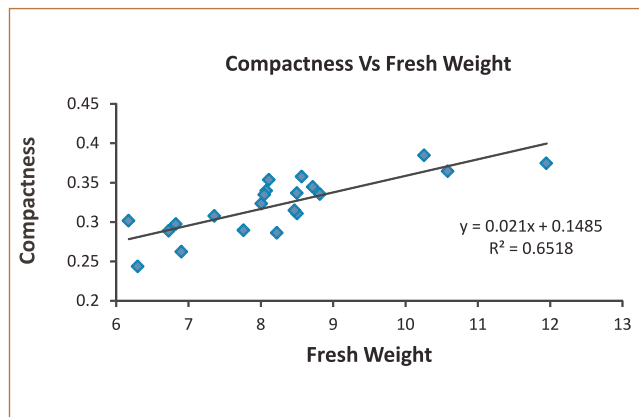
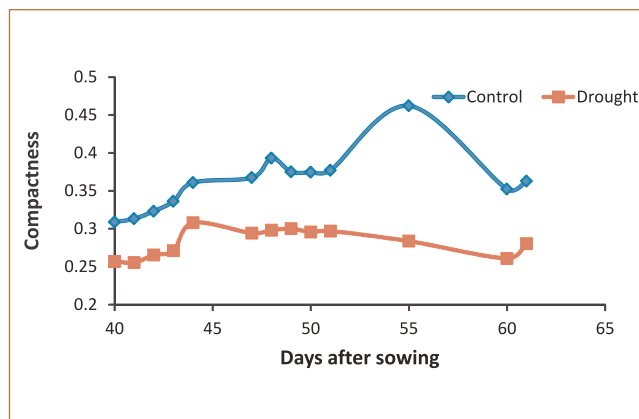
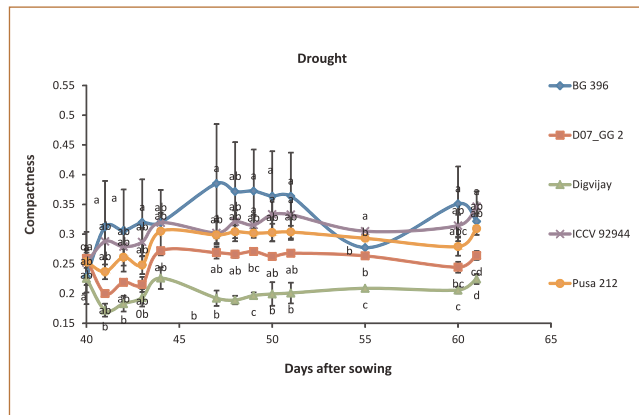
*Ranej*

(Jagadish Rane)

## High throughput phenomics for characterising genetic diversity drought responses of Chickpea genotypes

(Dr Jagadish Rane, Principal Scientist, Plant Physiology)

Twenty two genotypes of chickpea including local check Digvijay were tested under water deficit condition in National plant phenomics facility, ICAR-NIASM, Baramati. Experiment was conducted to optimise image based phenotyping method to assess responses of chickpea genotypes to depleting soil moisture stress and identification of promising genotypes superior to locally adapted genotypes. Soil moisture was maintained in the range of 47-66 per cent of the field capacity. Digital top view area as viewed by high resolution camera as well as NIR intensity and compactness can help in differentiating the response of chickpea genotypes to depleting soil moisture in high throughput mode. Compactness also revealed the genotype ICCV-92944 performed better with the genotype Pusa 212 than other genotypes. The same genotype showed statistically significant results. Genotype ICCV-92944 can be a promising candidate which can be used as donor for drought tolerance as it had high biomass relative to Digvijay and this could also be explained by top view area which may serve as alternate trait for large scale screening.



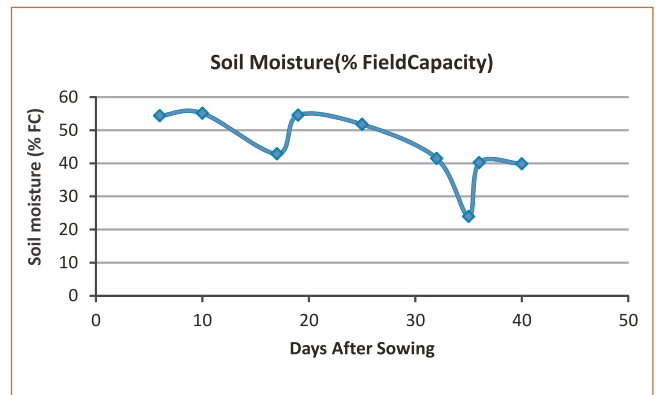
Genotypic variation in compactness under (a) control condition (b) drought condition. (c) overall difference in genotypes under drought and control condition (d) Correlation between compactness and fresh weight of plants. Data are in the form of mean  $\pm$  standard error mean (SEM) and means followed by the same letters with in the columns are not significantly different at  $P \leq 0.05$  using Duncun's multipale range test.

## Non-destructive measurement of biomass in pigeonpea genotypes through high throughput phenotyping

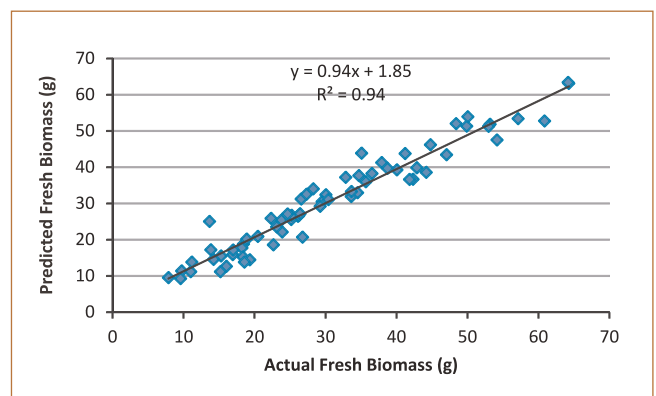
(Dr Jagdish Rane, Principal Scientist, Plant Physiology)

Plant biomass is one of the main parameter for growth analysis and yield prediction in different environmental condition. The conventional methods for biomass estimation are destructive, time tacking and they require big men power to production of systamatic data during plant life cycle. Image based high throughput phenotyping is a non-destructive automated method for biomass estimation of number of genotypes in different environmental condition in near real time during various developmental stages. In this experiment, we recommend a methodology to biomass estimation based on image derived phenotypic traits of 13 genotypes of pigeonpea. We proposed a linear model for estimating the plant digital biomass as a function of object extent  $x$ , object sum area, boundary points to area ratio, caliper length, convex hull circumference, roundness, digital biomass to produced the linear model. Proposed model showed  $0.94 r^2$  with observed biomass indicating that our model is useful for predicting plant biomass with image driven parameters with-out destroying plant. The model also tested by three-fold cross-validation technique. This model has been tested using pegionpea data sets under different moisture level. It is concluded that this model is performed better in different demostration. It would be helpful to estimate plant biomass without destroy plant by high-throughput image analysis at diferent growing stages and enviroment condition. Biomass is the good indicator of plant performance and final

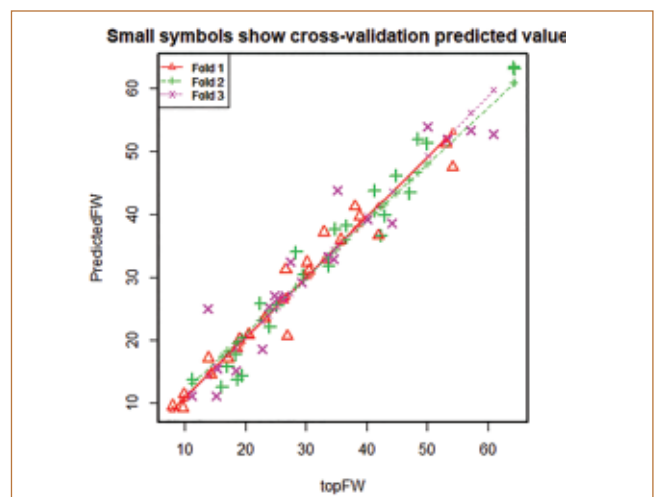
yield in different environment condition. So this model would be helpful for selection of better performing genotypes under different stress condition.



Soil Moisture depletion trend during experiments



Correlation between predicted and actual biomass



Three-fold cross-validation technique evaluated to the performance of these models using the R package "DAAG" where small symbol sowing cross validation prediction value.

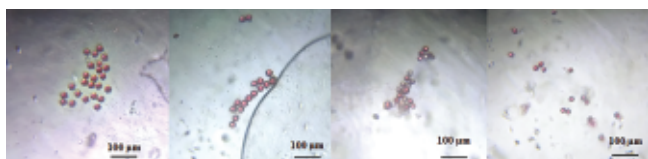
# Research Highlights

## Application of foldscope to study genotypic diversity in in vitro pollen viability and pollen germination of soybean (*Glycine max* (L.) Merrill)

(Dr Jagdish Rane, Principal Scientist, Plant Physiology)

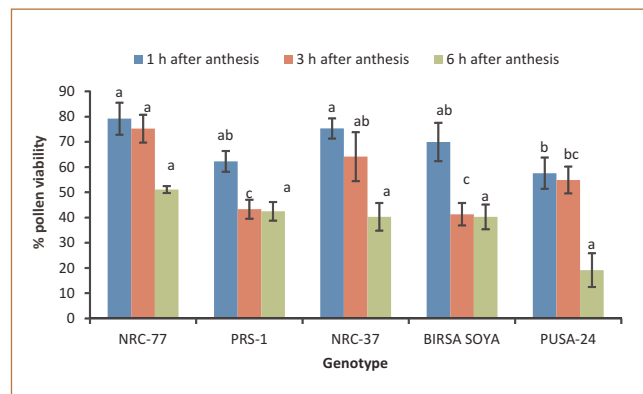
Foldscope is origami-based optical microscope with magnification from 140X to 2,000X and costs less than Rs. 200. An experiment was conducted to optimise foldscope based methods for the study of pollen viability and germination in soybean genotypes under drought stress. Pollen studies are important because the fate of pollen have a profound influence on crop yield as it has greater role in reproductive success. Temporal variation in pollen viability was exhibited by soybean genotypes that were well captured by foldscope. Colour of viable (red) and non-viable (colourless) pollens were efficiently differentiated and per cent pollen viability was calculated from the images captured. The maximum per cent pollen viability was observed 1 h after anthesis (79 to 58 %) and it gradually decreased over time (up to 6 h).

Low soil moisture stress reduced the in vitro pollen germination rate to an extent of 56 to 74 % compared to well-watered soybean genotypes studied in our experiment. The drought effect was found lesser (56 %) in the genotype CO-2 than others. The maximum per cent pollen germination was found in the genotypes CO-1 and CO-2 under water stress (20 and 22 % respectively) as well as well watered conditions (48 and 50 % respectively) which were statistically similar drought condition

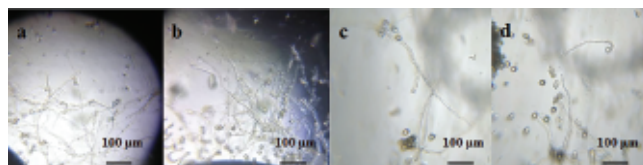


Representative images of viability of soybean pollens observed using Foldscope

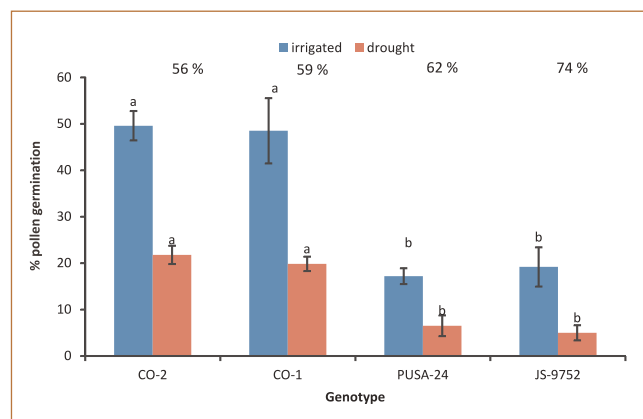
(21.79 to 5 %). The overall results revealed that Foldscope can be efficiently used as research tool for screening genotypes for drought tolerance on the basis of pollen physiology of crop.



Percent pollen viability of soybean at different time intervals after anthesis as calculated by using Foldscope images. Different letters above the bars indicate significant difference according to Duncan's multiple range test; the test was conducted independently for each treatment.



Effect of different moisture treatment on pollen germination a & b) irrigated treatment c & d) drought treatment of soybean genotypes



Effect of drought on pollen germination of soybean genotypes. % values indicate the per cent difference of pollen germination in irrigated and drought treatments. Different letters above the bars indicate significant difference according to Duncan's multiple range test; the test was conducted independently for each treatment.



## Effect of salinity on turmeric morphology and physiological parameter

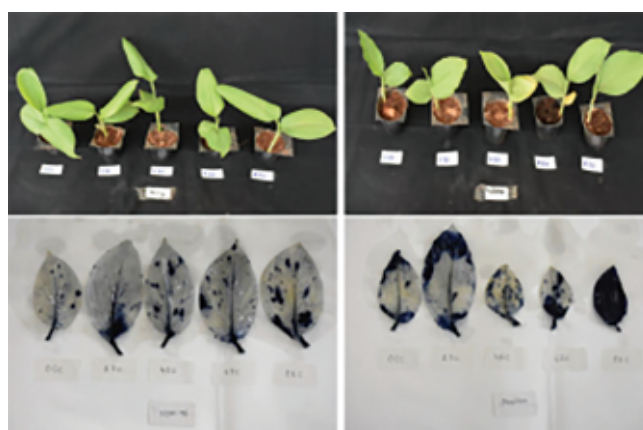
(Mr Harisha CB, Scientist, Spices, Plantation, Medicinal and Aromatic Plants)

The experiment was conducted with 10 varieties/cultivars of turmeric under five salinity levels (0 dSm<sup>-1</sup>, 2 dSm<sup>-1</sup>, 4 dSm<sup>-1</sup>, 6 dSm<sup>-1</sup> and 8 dSm<sup>-1</sup>) in three replications under controlled condition. Salt water is prepared using inorganic salts of NaCl, CaCO<sub>3</sub>, NaSO<sub>4</sub>. Irrigation water was give once in 10 days based on visual observations of water stress. The germination percentage and other morphological parameters were recorded including number of scorched leaves. It is found that scorching intensity of leaves due to salinity

Treatment	Plant ht. (cm)	Scorching intensity %	SPAD reading
0 dSm <sup>-1</sup>	14.02	0.0	30.9
2 dSm <sup>-1</sup>	13.6	16.6	27.1
4 dSm <sup>-1</sup>	12.2	25.9	28.3
6 dSm <sup>-1</sup>	11.7	25.3	27.4
8 dSm <sup>-1</sup>	10.8	32.3	24.7
CD @ 5%	1.83	6.61	2.37
NDH-1	11.6	24.6	27.1
Megha turmeric	10.8	7.93	25.1
R.sonia	13.5	12.3	29.8
Allepy supreme	13.9	18.9	26.6
Roma	11.0	17.6	25.8
Pratibha	10.7	22.6	23.8
Co-2	10.7	32.3	28.1
BSR-2	11.2	16.3	26.8
NDH-98	14.4	8.1	32.2
NDH-8	17.1	19.5	31.7
CD @ 5%	2.59	9.35	3.35

stress was more in Pratibha and CO-2 least in Megha turmeric and NDH-98. Similarly NDH-98 recorded higher chlorophyll fluorescence as compared to Pratibha which recorded lowest chlorophyll fluorescence recorded by SPAD

Saline water treated plants in nursery stage were used for histochemical detection of hydrogen superoxide (O<sub>2</sub><sup>-</sup>) anion one of the most important ROS. The intensity of staining was more in Pratibha as compared to NDH-98 and Rajendra Sonia which were tolerant to salinity up to 8 dSm<sup>-1</sup>.



Most tolerant variety      Most susceptible variety  
Nitroblue tetrazolium (NBT) staining of turmeric leaves affected wit salinity

The critical symptoms of salinity in turmeric are seen in older leaves first with marginal yellowing in the young stage and become necrotic as age advanced. It also observed that tip of leaf shows yellow, pale necrotic patches.



Turmeric leaves showing salinity toxicity symptoms at EC of 8 dSm<sup>-1</sup>

# Research Highlights

## Development of herbal medicinal garden in shallow basaltic soils and its performance

(Mr Harisha CB, Scientist, Spices, Plantation, Medicinal and Aromatic Plants)

Herbal consists of 65 species of trees, shrubs and climbers were developed in shallow basaltic soils of Deccan plateau of Maharashtra. The plant is developed by digging pits of 1.5m x 1.5m for bigger trees and 1m x 1m for small shrubs and climbers. The planted trees were established well and few of them were failed to establish due to soil condition and non-suitability of climate. The morphological and physiological observations

were recorded to assess the performance of the plant species. It is found that many of the tree species are adopted and successfully growing in poor soil condition having shallow depth and rocky underneath. Among them neem, wood apple, palash, shami, shivan, putranjeeva, coral tree, bael, mahuva, hirda, behda, red sanders, eucalyptus, curry leaf, lime, kutaj, Sesbania, nirgudi, aromatic gasses etc. are performing well and they showed vigorous growth as compared to planting season. The well-established plants have higher chlorophyll content and also cooler plant canopy temperature. This indicates the adoption to the present soil and climatic conditions.

**Table:** Plant growth of medicinal trees in two seasons and successive growth from planting

Sr. No	Plant species	Plant height (cm)		
		Sum-mer	Kharif	Succe-ssive growth
1	Ashoka	38	40	2
2	Neem	126	176	50
3	Palash	47	77	30
4	Kadamb	81	102	21
5	Simaruba	89	108	18
6	Shami	61	76	16
7	Wood apple	67	120	54
8	Soap nut	98	221	123
9	Shivan	45	106	61
10	coral tree	37	45	8
11	T. chebula	50	81	31
12	T. bellarica	43	115	72
13	T. arjuna	72	137	65
14	Beal	27	73	46
15	Jamun	108	139	31
16	Wax Apple	72	73	2
17	Mahuva	54	109	55
18	Putranjeeva	32	52	20
19	Mahagony	82	91	9
20	Annato	42	74	32

Sr. No	Plant species	Plant height (cm)		
		Sum-mer	Kharif	Succe-ssive growth
21	Henna	99	98	0
22	Khair	39	135	96
23	Shikakai	95	128	33
24	Fever nut	53	85	32
25	Agnimantha	75	90	14
26	Bakul	25	33	9
27	Guggal	68	118	50
28	Red Sanders	56	85	29
29	Sandalwood	56	51	-5
30	Madhukamini	63	88	25
31	Curry leaf	51	91	41
32	Parijatak	78	113	35
33	Lemon scented gum	168	217	49
34	Nilgiri	115	147	32
35	Champaka	103	110	7
36	Sessbania	56	196	140
37	Kutaj	39	130	92
38	Danti	69	78	10
39	Nirgudi	59	110	52
40	Pongemia	76	88	12

In aromatic plants such as eucalyptus (two species), lemon grass (four varieties) essential oil was extracted and quantities in various seasons to find the effect of season, soil condition on oil content and also chemical constituents of volatile oil. It was found that in *Eucalyptus citrodora* oil content was increased in kharif season as compared to *Eucalyptus globulus*. In case of lemon grass varieties CKP 25 and Praman shows increased oil content in kharif as compared to summer. It was also observed that oil content of the herb may also vary with the age and stage of harvest.

**Table:** essential oil content in aromatic plants established in shallow basaltic soils

Plant species	Essential oil %	
	Summer	Kharif
<i>Eucalyptus citrodora</i>	1.05	1.54
<i>Eucalyptus globulus</i>	0.74	0.67
Lemon grass Kaveri	0.60	0.44
Praman	0.56	0.65
CKP 25	0.73	0.97
Chirharit	0.65	0.60



Native land 2018      Summer 2019      Kharif 2019

View of garden at different stages of land development and seasons

## Microbial cell lysate: an approach to mitigate drought stress in coriander

(Dr Kamlesh Kumar Meena, Senior Scientist, Agriculture Microbiology)

Owing to the commercial value of both the foliage and the seeds, the coriander is an important

spice crop in India. Fresh foliage of coriander is widely used in food, while the seeds serve as important ingredient in spices recipe. For seed production the coriander was cultivated during rabi season, during which a shortfall of water supply significantly limits the crop productivity. Therefore there is a frequent demand for sustainable strategy to achieve the optimal productivity of coriander under drought conditions. Microbial interventions for this purpose have gained significant attention in light of the increasing reports on improved performance of microbial products in drought-prone agriculture. We performed a field experiment with microbial cell-lysate (cytoplasmic extract; referred hereafter as the product) in coriander crop exposed to drought conditions generated using deficit-irrigation technique. The product was applied by means of foliar spray at weekly intervals, and the crop response was evaluated in terms of physicochemical markers including the content of chlorophylls, phenolic compounds, protein content, and activity of antioxidant enzymes superoxide dismutase (SOD), and ascorbate peroxidase (ASP).



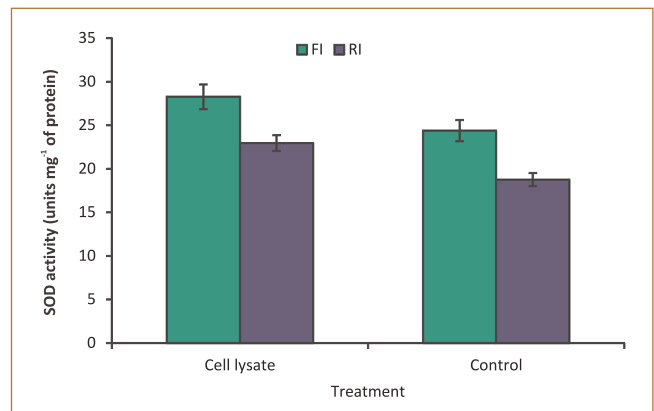
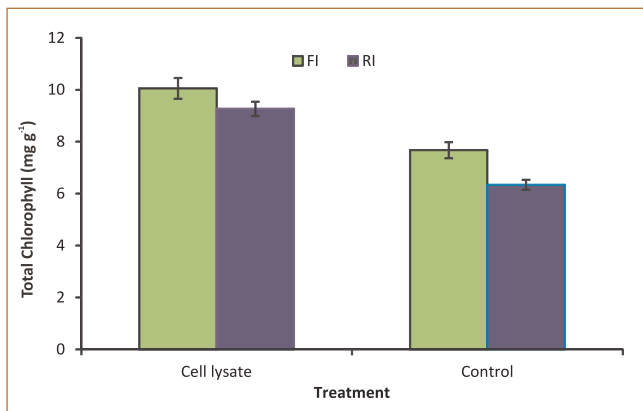
Cell lysate      Control



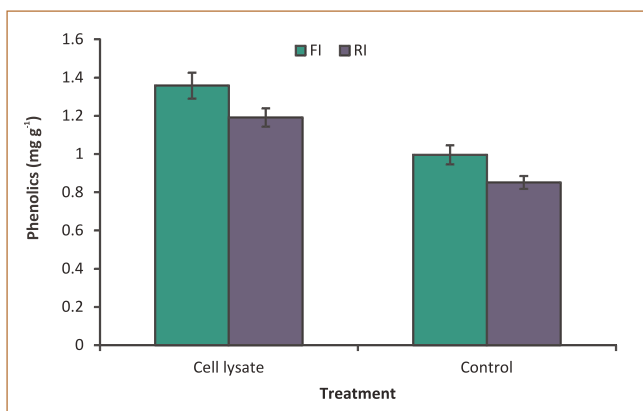
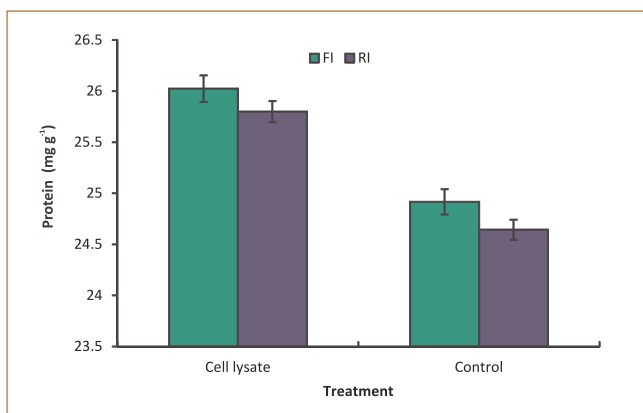
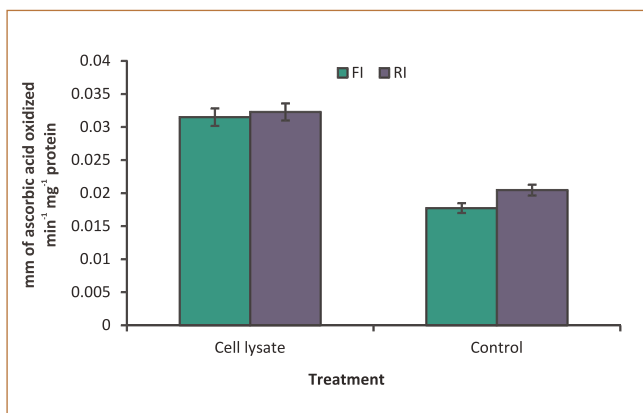
Cell lysate      Control

Response of the field-grown coriander crop to the foliar application of the plant-growth promoting microbial cell-lysate under drought conditions

# Research Highlights



Coriander-response to the foliar application of plant-growth promoting microbial cell-lysate under drought conditions



A higher content of the evaluated traits indicated induction of drought tolerance mechanism under the influence of the product application. Enhanced chlorophylls over the control indicated improved foliage quality, which is an important trait with respect to foliage yield. Further, the improvement in protein and phenolics compounds also reflected better biochemical status over the control, as the proteins, and phenolics content is known to rise during stress conditions in plants; and phenolic compounds have been shown to contribute an additional role of cellular signalling and non-enzymatic management of oxidative radicals in plants. The antioxidant enzymes SOD and APX are known for detoxification of oxidative radicals in plants. The oxidative radicals in absence of proper management system accumulate during drought conditions which cause severe damage to the vital cellular organelles and hinder the normal cellular processes. Application of the product under drought conditions successfully induced the activities of SOD and APX, thus signifying its performance towards management of oxidative stress. Thus, the overall results endorse the utilization of microbial cell-lysate for sustainable cultivation of the coriander in drought-prone areas.



## Wastewater treatment synergizing with integrated approach of constructed wetland and aquaponics

(Dr Paritosh Kumar, Scientist, Environmental Science)

Under the in-house project “Wastewater treatment through multi-approach based constructed wetland and use in integrated aquaponics”, NIASM septic tank wastewater is treating through a pilot scale constructed wetland system with the aim to test the potential of (1) Agricultural by-products incorporated multimedia based constructed wetland system for wastewater treatment (especially for removal of microbes), (2) Integration of wastewater treatment with floriculture industry and mainly to identify the floricultural crops suitable for constructed wetland system, and (3) Use of treated water for integrated horticulture and fish cultivation as aquaponics during treated water storage before its further use as irrigation water in the field.

The unit comprised of two parallel systems (i) Horizontal sub-surface flow based constructed wetland system (HSSF-CWs) and (ii) Vertical sub-surface flow based constructed wetland system (VSSF-CWs) filled with different growing cum filtration media viz. Gravel + Rice hull (HGH & VGH-CW), Gravel + Coco peat (HGP & VGP-CW), Gravel + Charcoal (HGC & VGC-CW), Gravel (HG & VG-CW) and along with a Medialess control (MC-CW) and Unplanted control (UC-CW) each with six replications. Each system has grown with two different flowering crops viz. marigold and aster. The treated water is collected from both systems and passed through a 25 Watt UV sterilization unit and used for growing Spinach and Pangasius fish in integrated aquaponics systems.



Horizontal sub-surface flow based constructed wetland systems (HSSF-CWs)



Vertical sub-surface flow based constructed wetland systems (VSSF-CWs)

Pilot scale Constructed wetland system at ICAR-NIASM, Baramati



Spinach and Pangasius based integrated Aquaponics maintained with NIASM treated water

## Pollutant removal efficiency

As per the analysis results, in NIASM Septic tank wastewater is loaded with microbial contaminants mainly coliform bacteria (*Fecal coliform* and *Escherichia coli* etc.) and their population represented at 95% confidence level as most probable number (MPN) in 100 ml of water was >1600 and resulting their biochemical oxygen demand (BOD) was higher (~250mg/l).

### (a) Effect of different growing cum filtration media

Among different HSSF-CWs filling medium was not sufficient to reduce the microbial contamination to safe limit recommended by WHO for their use for irrigation i.e. Total coliform population <1000 MPN/100ml, faecal coliform and *Escherichia coli* <100 MPN/100ml and BOD <

# Research Highlights

30mg/l). Gravel + spent mushroom compost (HGM-CW), Gravel (HG-CW) and medialess control system (HM-CW) system were able to reduce the total coliform population from >1600 to 1600, while Gravel + coco peat (HGP-CW) and Gravel + charcoal (HGC-CW) filled system to 910. *Fecal coliform* and *Escherichia coli* population was also higher than safe limit (100). However, among different filling media Gravel + Charcoal based system (HGC-CW) has performed best with total coliform population reduced from >1600 to 910, *Fecal coliform* to 240 and *Escherichia coli* 90 and their biochemical oxygen demand was also reduced from 250 to 23 mg/l.

## (b) Effect of Ultraviolet (UV) treatment

After passing through the 25 watt UV sterilization unit the microbial population of these wetland treated waters were considerably reduced further irrespective of the treatments and comes within the safe limit recommended by WHO either for total coliform (1000/100ml), *fecal coliform* (100/100ml) and *Escherichia coli* (100/100ml) and their BOD was also reduced below 30mg/l. However, among different filling media Gravel + charcoal based system has performed the best and their treatment was found consistent every month.

Apart from microbial other physicochemical parameters viz. pH, EC ( $\mu\text{S}/\text{cm}$ ), Turbidity (NTU), Dissolved Oxygen (mg/l), Temperature ( $^{\circ}\text{C}$ ), TDS (ppm), Salinity (ppm), ORP (mV), Carbonate (me/l), Bicarbonate (me/l), Chloride (me/l), Calcium +Magnesium (me/l), Sodium (me/l), Potassium (me/l), Sulphate (mg/L), Phosphate (mg/L), Fluoride (mg/L) as well as metals like Fe, Mn, Zn, Cu, As, Cd, Ni, Cr, Pb were found within safe limit.

## Economic yield by flower harvesting

As per earlier flowering crop performance Marigold and Aster has selected and grown in

June 2019 (third crop season) on both HSSF-CWs and VSSF-CWs with plant population 5 plants and 2 plants/system, respectively. In this crop season (Jun. to Sep. 2019) septic tank wastewater has spiked with multi metal mixture viz. Fe, Mn, Zn, Cu, Cr, Cd, Pb and Ni of 1.0 ppm concentration and evaluated further for their performance under microbial + heavy metal stress.

Among the grown flowering crops marigold has performed the best with total flower harvesting (till now) of 1851 flower number and 9.78 kg from horizontal system (HSSF-CWs) while 406 flower number and 2.61 kg from vertical systems (VSSF-CWs). However, Aster flower number was confined to 245 and 50 in (HSSF-CWs) and vertical systems (VSSF-CWs), respectively. The result also clears that among horizontal (HSSF-CWs) and vertical systems (VSSF-CWs) average flower yield was higher in horizontal system. However, among different growing media average marigold flower yield was found in the order:

## Aquaponics system

Aquaponics system was grown in 90 liter capacity one feet deep circular water tank filled with Typha treated water (TW), Vetiver treated water (VW), Gravel treated water (GW), Gravel+Charcoal treated water (GCW), Gravel+Rice hull treated water (GHW), Gravel+Coco peat treated water (GPW) along with fresh water (FW) and Untreated septic tank metal spiked water (UW) as control; in triplicate. Each tank was grown with spinach and Pangasius fish in integrated manner with plant population 7 plants/tank and fish population 12 fish/tank.

In untreated control tanks (UW) all the 12 fish were died in seven days due to very less dissolved oxygen content (1.0 mg/l) and spiked metal pollutant load (1.0 mg/l of Fe, Mn, Zn, Cu, Ni, Cr,

Pb, Cd) i.e. 100% mortality was observed. However, in metal spiked treated waters 62.80%, in nonmetal spiked septic tank treated waters 40.28% while in freshwater tanks 50% fish died in 2 months. After two month among different treatments fish mortality was found in the order:

UW (100%) > GW (66.67%) > GCW (61.11%) > GPW (52.78%) > FW ~ GHW (50%)

However, after two months increase in average body weight of applied fish was found in order:

GW (117.3%) > VW (111.9%) > TW (90.3%) > GPW (82.1%) > GHW (77.6%) > GCW (52.8%) > FW (51.8%) > UW (0%)

From these 30 aquaponics system of 210 plants in first harvest 4.325 kg spinach has harvested. Among different treatments, the average amount of spinach harvested was found in the order:

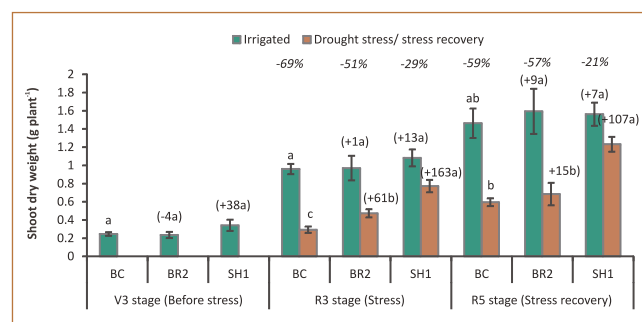
GW (312.3g) > UW (245.0g) > GPW (204.0g) > FW (179.3g) > GHW (153.3g) > GCW (125.0g) > TW (117.3g) > VW (105.3g)

## Cow urine based formulations supports cell membrane water channels called aquaporins

(Dr Jagadish Rane, Principal Scientist, Plant Physiology)

Aquaporins are membrane proteins that serve as channels in the transfer of water across the cell membranes. They can also allow small solutes across the membrane. They are present in bacteria, plants, and animals. Structural analyses of the molecules have revealed the presence of a pore in the center of each aquaporin molecule. Several aquaporin-type water channels are expressed in mammalian kidney. In one of the experiments with mungbean plant, an hypothesis that cow-urine based formulations can influence drought

responses of plant through aquaporin was tested. In addition to promotion of plant growth, the bioformulation was also found to enhance the level of expression of genes coding for aquaporin in plants and improve plant growth and development under depleting soil moisture conditions.



Effect of bio-formulations and moisture conditions (irrigated, drought stress and stress recovery) on shoot dry weight of mungbean plants

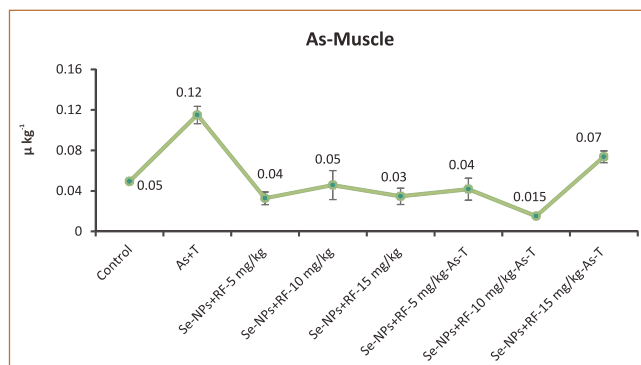
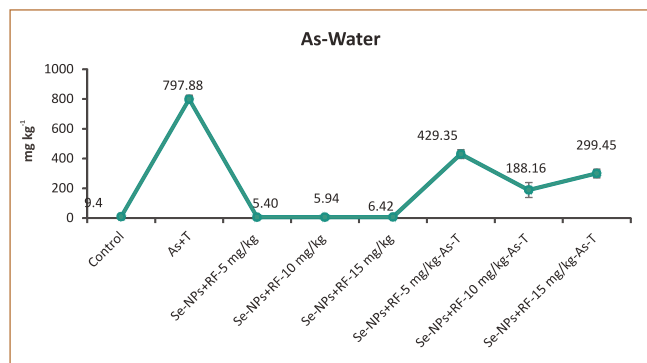
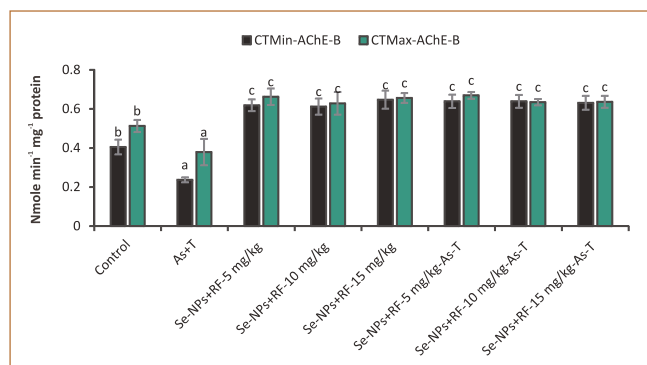
## Synergistic effect of dietary Selenium nanoparticles and Riboflavin on enhanced thermal efficiency of fish against multiple stressors (IXX09673)

(Dr Neeraj Kumar, Scientist, Fish Nutrition and Biochemistry)

An experiment was designed to delineate the efficacy of a dietary combinatorial mixture of selenium nanoparticles (Se-NPs) and riboflavin (RF) on thermal efficiency/tolerance of the *Pangasianodon hypophthalmus* reared under arsenic (2.8 mg/L) and high temperature (34 °C). Green synthesis method employed for the synthesis of Se-NP using fish gill which are normally discarded as by-product. Four isocaloric and iso-nitrogenous experimental diets viz. control (Se-NPs and RF @ 0 mg/kg diet), RF @ 5, 10 and 15 mg/kg diet with Se-NPs @ 0.5 mg/kg diet fed for 95 days. At the end of the feeding trial, the thermal tolerance study viz. [critical thermal minimum (CTmin), lethal thermal minimum (LTmin), and critical thermal maximum (CTmax), lethal thermal maximum (LTmax)] was evaluated. The anti-

# Research Highlights

oxidative status in the form of catalase, glutathione-s-transferase (GST) and glutathione peroxidase (GPx) activities were significantly ( $p < 0.01$ ) enhanced on concurrent exposure to arsenic and high temperature during LTMin and LTMax, whereas non-significant ( $p > 0.05$ ) change of superoxide dismutase (SOD) in the brain during LTmin and brain, gill and kidney during LTMax. The supplementation of Se-NPs @ 0.5 mg/kg diet and RF @ 5, 10 and 15 mg/kg diet significantly ( $p < 0.01$ ) improved the anti-oxidative status with or without stressors. AChE activity in the brain was significantly ( $p < 0.01$ ) inhibited on concurrent exposure to arsenic and high temperature and improved in the treatment group supplemented with Se-NPs and RF. Arsenic concentration in muscle and experimental water and Se concentration in muscle and experimental feed were analysed. Overall, results indicated that supplementation of RF @ 5 mg/kg diet with Se-NPs @ 0.5 mg/kg diet could confer protection to fish against arsenic and thermal stress and led to enhance thermal efficiency/tolerance of *P. hypophthalmus*.



Arsonic concentration in muscle and experimental water and selenium concentration in muscle and experimental diet

## Exposer to multiple salinity level levels on growth response of GIFT Tilapia

(Mr Mukesh P Bhendarkar, Scientist, Fish Resource Management)

A two months study was conducted in rectangular aquarium tanks having dimension 2x1x1 feet to investigate the effect of different salinity levels on growth performance and survival of Nile tilapia (*Oreochromis niloticus*). Saline water having 15 ppt salinity were brought from farmer field at Kambaleswar, and transported to the fisheries wet lab by water tanker. Experimental design were prepared with variable salinity levels maintain such as 15 ppt, 10 ppt, 05 ppt, freshwater (control) and saline water (control) designated as T1, T2, T3, T4 and T5 respectively with three replication each. Fish of an average initial weight  $0.9 \pm 0.001$  g were randomly assigned to each aquarium tank at the rate of 10 fishes per tank.

This study was conducted to investigate growth variations of GIFT tilapia among the three different storage tank viz FRP tank, Cement tank and Polytenes lining pond. Total length and body weight was taken initially during stocking having average length  $2.50 \pm 0.04$  cm and weight 0.2 gm ABW. It was observed that average body weights



# Research Highlights

attained by tilapia  $370 \pm 30.2$  g during sampling with 0.8 FCR.

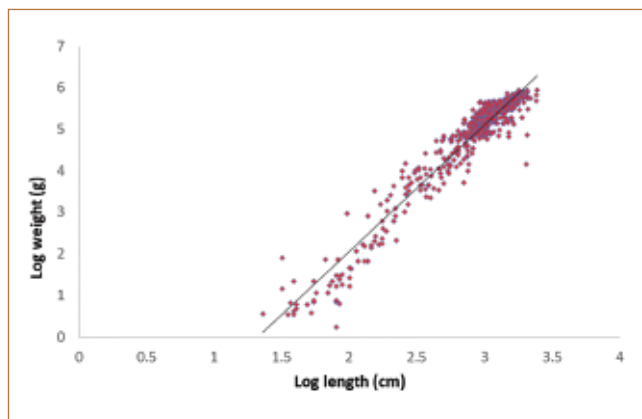


## Length-weight relationship of GIFT Tilapia under culture condition

The regression equations obtained are shown in graph, with 'X' variable as length and 'Y' variable as weight. It was found that the total 828

specimens were examined (LT = 3.9 to 29.7 cm, W = 2.27 to 383.38 g) during sampling (under culture pond) for the length-weight relationship. Independent statistical analysis of their length and weight relationship gave the following regression equations.

$$W = 0.0156 L^{3.0999}$$



## Major events

### Inauguration of 11/0.433 KV Electrical Substation

The "11/0.433 KV Electrical Substation" at ICAR-NIASM, Gat-35 Malegaon Khurd, Baramati was inaugurated by Prof. Narendra Pratap Singh



Inauguration of Electric sub-station on July 30th 2019.

Director, ICAR-NIASM and the OIC (works) and Works committee members were present. Er. Ramesh Rai, Assistant Engineer, Electrical CPWD and Er. Vinod Ganvir Assistant Engineer, Civil CPWD were also witnessed for this event on July 30th 2019. Er. Ramesh Rai briefed the details and features of Electrical Substation.

### Inauguration of Krishna Residency' (Type III & IV Quarter) at MIDC, Baramati

The 'Krishna Residency' (Type III & IV Quarter – Eight nos. each) at ICAR-NIASM residential complex MIDC Baramati was inaugurated by Prof. Narendra Pratap Singh, Director, ICAR-NIASM in presence of Er. Sushil Prasad, Executive Engineer (Civil), Er. Vinod

## Major events

Ganvir, Assistant Engineer (Civil) and Ramesh Rai, Assistant Engineer (Elect.) from CPWD Pune, Dr. D. D. Nangare OIC (works), Shri. B. K. Sinha, SAO, Mrs. Purnima S. Ghadge, AAO and Works committee members ICAR-NIASM were also witnessed on this occasion on July 20, 2019.



Inauguration of Krishna residency on July 20<sup>th</sup> 2019.

### Swachh Bharat Abhiyan

Under Swachh Bharat Abhiyan during April 2019 to September 2019 various Swachhata Action Plan (SAP) approved activities has carried out in the institute in which more than 150 persons including scientific, administrative, technical, young professionals, research fellows and

Date	Activity	Number of participants
30th April, 2019	Cleaning of plastic waste from the premises of administrative and school building	50
07th June, 2019	Collection of plastic wastes from the premises of hostel building, labour shed and Type-IV residential quarters	35
25th July, 2019	Planting Mango and Ber in administrative block area	70
6th June, 2019	Cleaning the medicinal block area	150

contractual labours participated and contributed more than 50 hours.

For basic maintenance cleaning, and sanitation activity nine workers are taking care of cleaning the toilets, office building premises, doing weeding and plantation of flowering plants in front of the office building, regularly. All the institute employee perform the dusting and cleaning the sitting areas of their respective office rooms, labs and farms. For development of green-belt and beautification inside the institute campus a medicinally important trees and shrubs based garden named 'Sanjivani garden' has established. In this garden more than 1500 medicinal plants has planted. In the administrative block area more than 500 mango and ber plants has planted while road sides of Type-IV residential quarters, hostel building and guest house different flowering trees and shrubs has planted.

For management of bio-degradable solid waste including crop residue, weeds, kitchen waste, animal unit waste etc. and to generate wealth from waste a vermicomposting unit of 10 tonnes/year capacity is working at waste dumping site in the institute campus. The unit consists of eight pits of 5.0×1.0×0.9 meter dimension covered with shed. In this unit two types of earthworm species has used for compost preparation Red wigger worm (*Eisenia fetida*) and African night crawler (*Eudrilus eugenia*) for rapid decomposition of green and dry farm waste. Since January 2019 more than 2.5 tonnes compost has collected from eight pits in one round and sold/used in the campus.

For management and reuse of liquid waste generated in institute campus a vertical subsurface flow constructed wetland system based wastewater treatment system of 3000 liters/day capacity is running near septic tank site and the

treated water is used for vegetable and fish production and then be used in nearby horticultural orchards (like guava, fig and aonla etc.) to supplement the irrigation water demand during dry periods. To make the institute campus plastic waste and Parthenium free cleaning and eradication drive conducted every month.

As per the order of Secretary, Government of India, Department of Drinking Water & Sanitation, Ministry of Jal Shakti and approval of Secretary (DARE) & DG (ICAR) and Director, NIASM 'Swachhata Hi Sewa' campaign has organized in the institute from 11th September 11 to October 02, 2019 on the theme "Plastic Waste Management". The campaign has started with Swachhata Oath and after that we carried out cleaning and plastic waste collection activities at various places in the institute campus like in the premises of institute main gate and peripheral roads, administrative building, school building, hostel building, guest house, residential quarters, old office building, crop farm, horticultural orchards, animal unit, fish unit, medicinal block garden etc. We have also conducted several competitions like essay competition on the topic 'Plastic waste management', debate competition on the topic 'Plastic should be banned or managed' and poster competition having 'Slogan on Awareness about plastic waste or single use plastics with institute logo'. The selected posters has distributed to Malegaon shops for display for awareness about single use plastic among customers and facilitating to carry their own reusable bags/bottles/pan. On September 25, 2019, we have conducted "Plastic waste collection and awareness drive" in the premises of Tukai Devi temple (Tourist spot) at Karawaganj Village (situated about 4 km away from our institute). On October 01, 2019 we have conducted 'Awareness programme to reduce single use plastic and proper disposal of plastic

waste' among the students of Jilha Parishad Prathmik Shala, Malegaon Khurd and also conducted a "Village cum School level rally" in Malegaon Khurd for public awareness for plastic waste. In this rally 106 students and teachers of the school also joined with us. October 01, 2019, we have also conducted a Workshop on the topic "Innovative ideas for Plastic waste management" in Punjab Singh conference room of the institute. We have organized 'Swachh Bharat Diwas' a massive shramdaan for plastic waste collection in the premises Yamai Devi mata temple, Malegaon Khurd (situated 2 km from the institute) on October 01, 2019 and in the premises of Nageshwar temple, Malegaon Budruk (situated 5 km from our institute) on October 02, 2019. We also distributed prizes to the winners of the various competitions during the closing ceremony of this campaign.

### **National Fish Farmer Day celebrated at ICAR-National Institute of Abiotic Stress Management, Baramati**

*(Dr M P Brahmane, Dr M P Bhendarkar)*

The ICAR-National Institute of Abiotic Stress Management, Baramati celebrates the 19<sup>th</sup> National Fish Farmers' Day at Baramati on 10<sup>th</sup> July 2019. Mr. Abhay Deshpande, Regional Deputy Commissioner, Fisheries, Pune division was the Chief Guest on this occasion. He emphasized on the need of learning the newer fisheries technologies for doubling farmer's income through skill development. Addressing the gathering, Dr. Jagdish Rane, ICAR-NIASM Principal Scientist and In-charge Head briefed about the achievements of the Institute. On the occasion of this event one day training programme was organized in collaboration with National Fisheries Development Board, Hyderabad. Around 150 fish farmers from different district of



## Major events

Maharashtra were present at the event. A scientist-farmer interaction session was also organized on the theme 'Sustainable fisheries and aquaculture development through intervention of scientific fisheries technology.



### **ICAR-National Institute of Abiotic Stress Management (ICAR-NIASM), Baramati organized one-day workshop on "climate smart technologies for sugarcane cultivation"**

*(Dr Yogeshwar Singh, Dr Aliza Pradhan, Mr Amresh Choudhary)*

The motto for organizing this program was to generate awareness among farmers about the climate smart ways of tackling problems of water scarcity, trash burning and controlling pest and disease problems in changing climatic scenario. The Institute Scientist team who actively arranged all the facilities for this workshop. A whole day program was scheduled including lectures and field visit. About 175 farmers and 25 guests had attended this program. The inaugural session was chaired by Prof. Narendra Pratap Singh, Director, ICAR- NIASM, Dr. Alaka Padhi, Deputy General Manager, NABARD, Pune, Shree Ranjankumar Taware, Chairman, The Malegaon Sahkari Sakhar Karkhana, Malegaon and Shree Sunil V. Pawar. Dr. N.P. Singh, Director, ICAR-NIASM welcomed all the dignitaries on the dice and informed the gathering about the current situation of sugarcane

production and problems arisen due to climate change in this crop in this address to guests and farming community present in the workshop. Dr. Alaka Padhi, Deputy General Manager, NABARD, discussed the about the role of NABARD in agricultural development by financing different programs, workshops, developmental and research projects to various organizations for the benefit of farmers. Shree RanjanKumar Taware 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. There are three lectures of related to climate-smart production system of sugarcane, innovative methods of disease and pest management and new varities of sugarcane for better adoption to



Dr. Alka Padhi (DGM, NABARD) along with Mr. Rajan Kumar Taware, Chairman, MSSK sugar factory, lightening the lamp during the inauguration function



Prof. N. P. Singh (Director, ICAR-NIASM) addressing farmers about the workshop



abiotic stress condition were delivered by experts. Two progressive farmers who are getting higher productivity of sugarcane has also shared their experiences to farmers regarding their management skills to manage sugarcane trash without burning and adopting integrated nutrient management in sugarcane cultivation. Director, ICAR-NIASM has expressed his gratitude towards sponsors of this workshop including NABARD, United Phosphorus Limited and State Bank of India, Baramati branch for funding this workshop.

### 73<sup>rd</sup> Independence Days Celebration

ICAR-NIASM celebrated 73<sup>rd</sup> Independence on August 15<sup>th</sup> 2019. All the staff including scientific, technical, administrative, SRF, JRF, YPs and contractual were present for the event. On this occasion Dr Jagdish Rane, Director, ICAR-NIASM has hoisted the national flag and addressed to the staff of ICAR-NIASM.



73<sup>rd</sup> Independence Days Celebration at ICAR-NIASM

### MoU with Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola

The ICAR-NIASM, Baramati joint hands with Dr Panjabrao Deshmukh Krishi Vidyapeeth, Akola to promote collaboration in research for abiotic stress tolerance in crops of Vidarbha region by involving post graduate students and scientist across the discipline.



Director, Prof. Narendra Pratap Singh signing the MOU with Dr PDKV, Akola

### हिंदी कार्यशाला

भारतीय कृषि अनुसंधान परिषद के दिशा निर्देशों के अंतर्गत राष्ट्रीय अजैविक स्ट्रेस प्रबंधन संस्थान में राजभाषा हिंदी के प्रयोग को बढ़ावा देने हेतु हिंदी सप्ताह (13 सितंबर-20 सितंबर) का आयोजन किया गया। हिंदी दिवस तथा हिंदी सप्ताह कार्यक्रम का उद्घाटन संस्थान के निदेशक डा. जगदीश राणे की उपस्थिति में संपन्न हुआ। संस्थान के निदेशक डा. जगदीश राणे ने सभी का स्वागत करते हुए अपने संबोधन में संस्थान के दैनिक कार्यों में राजभाषा हिंदी के प्रयोग को बढ़ावा देने का आह्वान किया तथा हिंदी भाषा के प्रचार-प्रसार हेतु सुझाव भी दिए। इस अवसर पर श्री. सतीश कुमार, सदस्य सचिव, हिंदी राजभाषा कार्यन्वयन समिति ने राजभाषा हिंदी के प्रयोग को बढ़ावा देने हेतु संस्थान में किए जा रहे प्रयासों एवं कामकाज का ब्योरा प्रस्तुत किया। हिंदी सप्ताह 2019 के दौरान संस्थान में विविध प्रतियोगिताओं का आयोजन किया गया। हिंदी निबंध लेखन, वाद-विवाद प्रतियोगिता, गीत गायन/काव्यवाचन, हिंदी टिप्पण लेखन, आशुभाषण प्रतियोगिता, प्रश्नोत्तरी प्रतियोगिता आदि प्रतियोगिताओं का आयोजन किया गया। इसी दरम्यान हिंदी भाषा को बढ़ावा देने के लिए 19 सितम्बर को एकदिवसीय हिंदी कार्यशाला का भी आयोजन किया गया। इस एकदिवसीय कार्यशाला के दरम्यान हिन्दी भाषा के प्रचार-प्रसार तथा कार्यलय प्रयोग को बढ़ावा देने के तौर-तरीकों पर गहन विचार विमर्श

## Major events

किया गया। संस्थान के सभी कर्मचारियों ने बद्ध-चढ़ के इस कार्यशाला में हिस्सा लिया। हिंदी सप्ताह 2019 का पुरस्कार वितरण एवं समापन समारोह 24 सितंबर को संस्थान के डॉ. बी. पी. पाल कक्ष में हुआ। समापन एवं पुरस्कार वितरण समारोह की मुख्य अतिथि श्रीमती डा. इन्दु सावंत (निदेशक, द्राक्ष अनुसंधान संस्थान, पुणे) ने सभी विजेताओं को पुरस्कार वितरित किए। हिंदी सप्ताह के दरम्यान सतीश कुमार,



समारोह का दीप-प्रज्वलन करते समय निदेशक डा. जगदीश राणे एवं डा. अविनाश निर्मले तथा डा. अमरेश चौधरी

(सदस्य/सचिव राजभाषा कार्यन्वयन समिति) ने हिंदी भाषा का महत्व बताते हुए संस्थान के अधिकारी एवं कर्मचारियों को हिंदी भाषा में कार्य करने के लिए निर्देशित किया। हिंदी सप्ताह कार्यक्रम का समापन श्री परितोष कुमार, सदस्य राजभाषा हिंदी कार्यन्वयन समिति के धन्यवाद ज्ञापन के साथ संपन्न हुआ।



मुख्य अतिथि डा. इंदू सावंत, विजेताओं को पुरस्कार वितरण करते हुए



## Workshop/Seminar/Symposia/Conference

### Dr Jagadish Rane

- Komal R Pawar and Jagadish Rane (2019) poster presentation on प्रत्येक थैंब अधिक पीक : ठिबक सिंचन प्रणाली at Krushi Mela organised by Krishi Vigyan Kendra, Baramati at jawalarjun village on Sept 03, 2019.

### Dr Nitin P. Kurade

- Dr Nitin P. Kurade, visited DGCN COVAS, CSK HPAU, Palampur, Himachal Pradesh for successful conduction of the harmonization meeting and Board Certification Examination of Indian College of Veterinary Pathologist (ICVP) 2019 at Department of Veterinary Pathology held on Sept 13-15, 2019.

### Dr Kamlesh Kumar Meena

- Meena KK, Sorty AM, Wakchaure GC, and Bitla UM (2019). Bacterially derived biopolymer for enhancing abiotic stress tolerance and improving soil health at 4<sup>th</sup> international conference on agriculture and animal husbandary. University of Hyderabad, India on August 28-30, 2019.

- Patil RJ, Meena KK, Choudhary RL, Singh Y, Wakchaure GC, and Bhosle PP (2019). Conservation agriculture for improving the soil health, nutrient use efficiency, cane, water productivity and environmental quality in sugarcane cropping system at 4<sup>th</sup> international conference on agriculture and animal husbandary. University of Hyderabad, India on August 28-30, 2019.
- Shinde AL, Bitla UM, Sorty AM, and Meena KK (2019). Bacterial cell lysate for enhancing drought stress tolerance in coriander (*Coriandrum sativum* L) crop at 4<sup>th</sup> international conference on agriculture and animal husbandary. University of Hyderabad, India on August 28-30, 2019.
- Bitla UM, Sorty AM, Wakchaure GC, and Meena KK (2019). Halotolerant weed nodule associated Rhizobium enhances the yield and drought stress tolerance in fenugreek at 4<sup>th</sup> international conference on agriculture and animal husbandary. University of Hyderabad, India on August 28-30, 2019.

# Workshop/Seminar/Symposia/Conference/Training

## Dr Mahesh Kumar

- Attended workshop on Enhancing resilience and productivity of rice based system through precision agronomy, machine learning and ICT based tools at Chandigarh during August 24-25 2019.
- Attended workshop on Open Source Software KOHA and RFID at IASRI New Delhi during May 31<sup>st</sup> to June 1<sup>st</sup> 2019

## Mr Mukesh P. Bhendarkar

- Delivered introductory lecture on "गोड्या पाण्यातील मत्स्यव्यवसाय" on the occasion 19<sup>th</sup> National Fish Farmers' Day held at ICAR-NIASM on 10<sup>th</sup> July 2019.
- Delivered lecture on "शेततळ्यातील मासेमारी, उत्पादकी हमी भारी" in the one day NFDB funded training programme on "Sustainable fisheries and aquaculture development through intervention of scientific fisheries technology" held at ICAR-NIASM on July 10<sup>th</sup> 2019.
- Delivered guest lectures on "Management of Common Craps and Water Quality" in the three

days NFDB funded training programme on "Shet Talyatil Matsya Palan" held at Krishi Vigyan Kendra, Baramati on August 29<sup>th</sup> 2019.

## Dr Neeraj Kumar

- Delivered lecture on in one day NFDB funded training programme Fish feed management held at ICAR-NIASM on July 10, 2019.

## Dr Paritosh Kumar

- Attended 3 days training programme on "Improving alternatives to reduce, reuse and recycle for waste management and value addition with emerging technology", Organised by Vaikunth Mehta National Institute of Co-Operative Management (VEMNICOM), Pune on July 2-4, 2019
- Paritosh Kumar, Harisha CB, Neeraj Kumar, Kamlesh Kumar Meena, Jagdish. Advances in Agriculture and Animal Sciences towards Global Food Security at 4th International Conference on Agriculture and Animal Husbandry at School of Life Sciences, University of Hyderabad, August 28-30, 2019.

## Publications

- Harisha CB, 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.
- 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 (In Press)
- Kumar N, Brahmchari RK, Bhushan S, Thorat ST, Kumar P, Chandan NK, Kumar M, Singh NP (2019) Synergistic effect of dietary selenium nanoparticles and riboflavin on the enhanced thermal efficiency of

fish against multiple stress factors. Accepted. 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

## Others Publications

- हरीष सी. बी., नरेन्द्र प्रताप सिंह, योगेश्वर सिंह और प्रवीण तावरे, 2019. चन्दन तथा रक्त चन्दन – शुष्क भूमि का सोने का खजाना, किसान खेती, अंक 2 :5-9



# Publications

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- Mr Harisha CB has telecast the programme on खराब और शुशक जमीनो मे औषधिये एवं सुगंधित फसलों की उत्पादन at DD Kisan on April 26, 2019
- Dr Yogeswar Singh has telecast the programme on benefit of Dragon Fruit at DD Kisan on April 23, 2019

## Personalalia

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### Superannuation

- Prof Narendra Pratap Singh, Director, ICAR-NIASM superannuated on July 31<sup>st</sup>, 2019

### Joining

- Dr Jagadisg Rane, Principal Scientist joined as Director (A) on Aug 1<sup>st</sup> 2019

### Selection

- Dr Yogeshwar Singh, Senior Scientist was selected as Professor in Rani Lakshmi Bai Central Agricultural University, Jhansi, Uttar Pradesh

### Promotions

- Dr Goraksh Wakchaure, Scientist (Ag. Structure and

Process Engineering) promoted to Senior Scientist level 12 as per 7<sup>th</sup> CPC, effective from February 10, 2018

- Dr Susheel Kumar Raina, Scientist (Plant Breeding) promoted to level 11 as per 7<sup>th</sup> CPC, effective from April 20, 2014
- Dr V Govindasamy, Scientist (Microbiology-Agriculture) promoted to level 11 as per 7<sup>th</sup> CPC, effective from April 20, 2014
- Dr Neeraj Kumar, Scientist (Fish nutrition and Biochemistry) promoted to level 11 as per 7<sup>th</sup> CPC, effective from January 01, 2018

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## Visiting International Scientist



Mr. Abdalrhman Goma Garo Adam, Scientist, Agriculture Research Corporation, Sudan has been awarded six month training on Plant Phenomics at ICAR-National Institute of Abiotic Stress Management, Baramati, Pune under Award of Research Training Fellowship-Developing Countries Scientist (RTF-DCS) instituted by DST Govt. of India from June 10<sup>th</sup> 2019 to December 10<sup>th</sup> 2019.



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