September
2020

# Project Coordinator

*.... a monthly update*


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

# Project Coordinator

.... a monthly update

Issue 3 | September 2020 | Page 02


## 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 September, 2020 and targets for October, 2020. During the month, along with the common project related activities three national webinars *viz.*, Farmers' Constraints in Dragon Fruit Cultivation; Climate smart integrated farming systems and halophytes for alleviating salinity stress in agriculture: potentials and problems, were organized.

The webinars provided an opportunity to listen to experts from different disciplines from India and abroad for participants which included scientists, entrepreneurs, farmers and students. It was also emphasized to explore possibilities of research collaboration with national and international institutes for further research. The Project Coordinator also includes sections on 'Insights from global research' and 'A leaf from history' on historical developments solely for reader's interest. I sincerely hope that this issue will help the scientists and the farm personnel of NIASM and other research Institutes to improve the coordination among scientists, technical, administrative and farm staff for 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)

## Contents




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During the last month, project activities comprised of data collection and analyses regarding effect of abiotic stress factors on crops, animals, fish and poultry, development and validation of an algorithm to study the genetic variation in crop plants based on thermal imaging parameters, installation of automation systems, analysis of weather parameters, crop intercultural operations, evaluation of germplasm traits to certain abiotic stresses, soil analyses, organizing webinars, communications for institutional collaborations, preparation/ submission/publication of agro-advisory, technical bulletin, popular articles and research papers, etc. followed by their plan of action for the upcoming month.

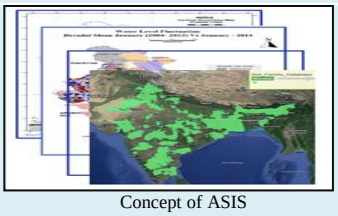
***"To forget how to dig the earth and tend the soil is to forget ourselves".***

***-Mahatma Gandhi***

## 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 Bulletin on "Abiotic stress in Agriculture: Geospatial characterization and management".
- Exploring collaboration possibilities with IWMI and ICAR-NIVEDI.
- Review of available sources of weather data and collection of few more weather station rainfall data.

## 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

Emasculation in dragon fruit flower

**Outputs**

- Processing for purchase of required research materials/consumables.
- Collaboration with ICAR-CSSRI, Karnal, was established regarding sharing of varieties/genetic stocks tolerant to soil salinity.
- Dr. Neeraj Kulakshetran, Principal Scientist and Head of crop improvement division, ICAR-CSSRI, Karnal is now associated with the project as Co-PI.
- Compilation of information for technical bulletin on varieties/genetic stocks tolerant to different Abiotic Stresses.
- Conducting a preliminary experiment to understand floral biology and different kinds of pollination effects on fruit formation and development.

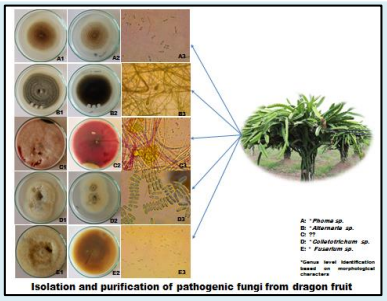
**Targets for next month**

- 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



Isolation and purification of pathogenic fungi from dragon fruit

**Outputs**

- LIS and installation of automation system work is ongoing.
- Release of earthworms for vermi-compost production (around 400 kg vermicompost was already produced from two pits).
- Collection of information on area, production and potential area of dragon fruit cultivation in different states of India.
- Collection of yield and post-harvest quality parameters of dragon fruit viz., average fruit weight, geometric mean, sphericity and TSS.
- Isolation and purification of the pathogenic fungi from dragon fruit.
- Irrigation and maintenance of medicinal garden.

**Targets for next month**

- Monitoring the progress of automation system installation in the field.
- Purchase of sandalwood seedlings along with layout, pit digging and planting.
- Recording of growth observations of tamarind trees.
- 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.
- Refilling of two pits with farm residue, followed by watering daily for next 20 days and release of worms.
- Analysis vermicompost quality parameters.

## 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

Application of farmyard manure in custard apple

**Outputs**

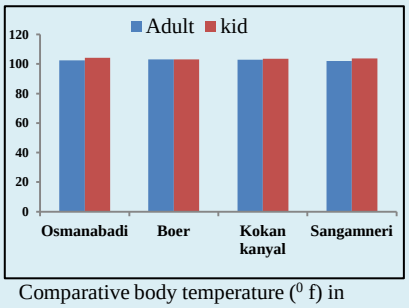
- Horticulture and agroforestry planting material procured from the market and planting process is in progress.
- Procurement and lining of geo-membrane HDPE sheet in fish pond is in process.
- Design for construction of multilayer farming has been completed.
- Analysis of soil samples has been done.
- National webinar on Climate-smart integrated farming system was organized on 18/9/2020 and more than 270 participants attended the programme.

**Targets next month**

- Procurement and lining of geo-membrane HDPE sheet in fish pond.
- Procurement of seeds and fertilizers for rabi season.
- Construction of structure for multilayer farming in IFS model.
- Installation of drip irrigation in multilayer farming plot.
- Planning and layout of fruit crop based mixed cropping system (multi-tier).
- Planting of Acid lime and papaya in the same.

## 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



Comparative body temperature ($^0$ f) in different breeds of goats adults and kids

**Outputs**
- Recording of physiological observations *viz.* body temperature, heart rate and respiratory rate in different breeds of goat during rainy season.
- Faecal sample evaluation for endoparasitic prevalence revealed presence of only trichuris sp. in a few goats during last month.
- Fruit fly monitoring and management in dragon fruit through pheromone and sticky traps.
- Generation of district wise monthly temperature trend maps of MH.
- Rainfall data collection of IMD stations.
- Development of questionnaire to understand the stakeholders requirements for the desired features in the chemical applicator for reducing evaporation losses from plastic-lined ponds.

**Targets next month**
- Evaluation of stress parameters and parasitic prevalence in different breeds of goat.
- Land preparation and conducting trial on ecofriendly IPM module for managing fall armyworm in maize.
- Collection and analysis of Meteorological data of MH.
- Study of teleconnections of IOD and ENSO with rainfall in Terai regions of India.
- Purchase of fish seed, stocking management, acclimatisation and conditioning of fish seed and post-stocking management of ponds.
- Development of live fish feed culture unit.
- Development of online performa for identification of stakeholders, collecting their responses and its analysis.

## FP 2. New Crops:
Exploiting Underutilised Crops (ex. quinoa) for Augmenting Income in Water Scarce Regions

**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

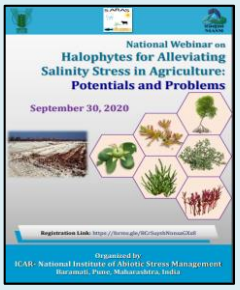

Bambara groundnut

**Outputs**
- Letter has been sent to Director, NBPGR requesting to share seed materials of potential crops *viz.*, quinoa, grain amaranth, bambara groundnut, chia for research.

**Targets for next month**
- Preparation of review article and technical bulletin on research progress 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



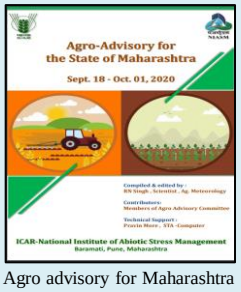
Webinar e brochure

**Outputs**
- Organisation of national webinar on "Halophytes for Alleviating Salinity Stress in Agriculture: Potentials and Problems" on 30$^{th}$ September, 2020.
- The aim the webinar was to explore the scope for utilisation of halophytes under abiotic stress conditions; source of microbes and genes for abiotic stress tolerance; identifying major researchable issues in utilising coastal and inland halophytes as feed and fodder crop and to create awareness on the role and value of potential halophytes for diversification of Indian food.

**Targets for next month**
- Preparation of technical bulletin and status review article on the halophytes and associated microbiome for ameliorating the saline soil of semi-arid region of the country.

## FP 4. Technology targeting and policy:
Targeting prospective technologies for abiotic stress resilience in rainfed and dryland regions

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



Agro advisory for Maharashtra

**Outputs**
- Two fortnightly agro advisories published on the Institute's website for stakeholders (English and Marathi versions).
- ITKs in Insect Pest Management compiled.

**Targets for next month**
- Completion of the technical report on Farm ponds of Maharashtra.
- 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:** N P Kurade

**Outputs**

- Environmental parameters to access stress levels in poultry birds collected and thermal stress risks assessed.
- Published technical folder entitled "Heat stress managemnet in poultry".

**Targets next month**

- Preparation of technical folder in local language for poultry farmers.
- Recording of environmental parameters to access stress levels in poultry.


Technical Folder on "Heat Stress Management in Poultry"

## B) School of Drought Stress Management (SDSM)

### 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


Webinar e brochure

**Outputs**

- One day national webinar on "Farmers' Constraints in Dragon Fruit Cultivation" (1st September, 2020) was organised with the aim to know status of dragon fruit cultivation; identifying the farmers' constraints and their views on dragon fruit cultivation; also to shortlist researchable and policy issues, as super crop for drought prone semi-arid regions of the India.
- More than 510 participants' *viz.*, dragon fruit farmers, scientists, entrepreneurs and students across the nation participated in the webinar.
- Recording of dragon fruit yield and quality attributes for better understanding of its cultivation constraints.

**Targets for next month**

- Preparation of technical bulletin of webinar on 'Farmers constraints in Dragon Fruit Cultivation'.

### 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

Recording of crop biomass and nodule count

**Outputs**

- Measurement of physiological parameters nodule weight, no. shoot and root weight at 50% flowering.
- Collection of soil samples for soil moisture measurement.

**Targets next month**

- Collection of plant samples for measuring crop growth rate, nodule weight, nodule count, shoot: root at pod filling stage.

## C) School of Edaphic Stress Management (SESM)

### 1. Dynamics of soil organic matter and primary nutrients in sugarcane-based cropping systems of abiotic stressed regions of Deccan plateau

**PI:** Amresh Chaudhary; **Co-PI(s):** Aliza Pradhan, Ram N Singh

Soybean cropping system

**Outputs**

- Analysis of soil micronutrients such as Fe, Mn, Zn, Cu.
- Analysis of soil Ca, Mg and S content.

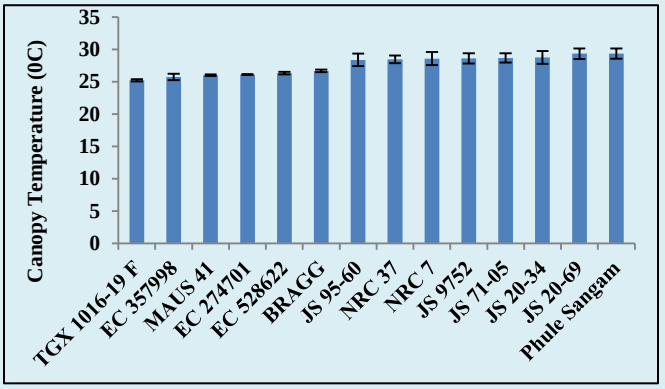
**Targets for next month**

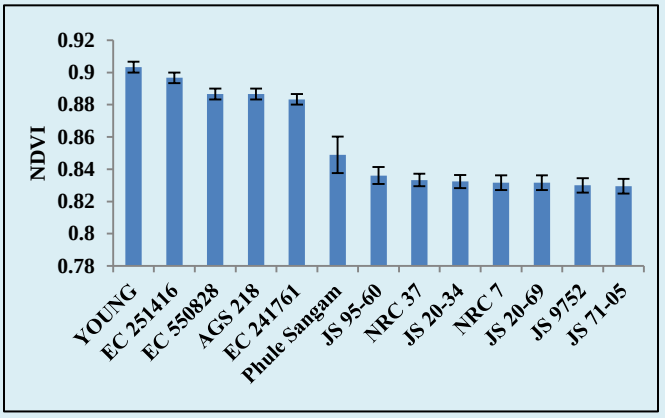
- Analysis of glomalin content in soil.
- Analysis of arylsulphatase enzyme activities in soil.

*"Weeding is as necessary to agriculture as sowing".*
*-Mahatma Gandhi*

## 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 canopy greenness of soybean genotypes

**Outputs**

- Soybean germplasms (160 Nos.) along with check varieties JS-7105 (drought tolerant), JS-9752 (drought tolerant) were evaluated for traits such as canopy temperature, canopy greenness under irrigated conditions.
- The genotypes TGX1016-19F, EC-357998, MAUS-41, EC-274701 and EC-528622 showed lower canopy temperature, while genotypes EC-251416, AGS-218, EC-242761 exhibited higher NDVI value as compared to check varieties JS-9752 and JS-7105.

**Targets for next month:**

- Evaluation of 75 soybean genotypes along with check varieties for root system architecture in PVC Pipes.
- Generation of VIGS plants for silencing ACS gene in soybean using *in vitro* transcripts inoculation.
- Evaluation of soybean germplasms (150) along with check varieties in Greenhouse for drought adaptive traits such as canopy temperature, PS-II efficiency, NDVI value, and water status (RWC).
- Plant DNA isolation from 150 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)

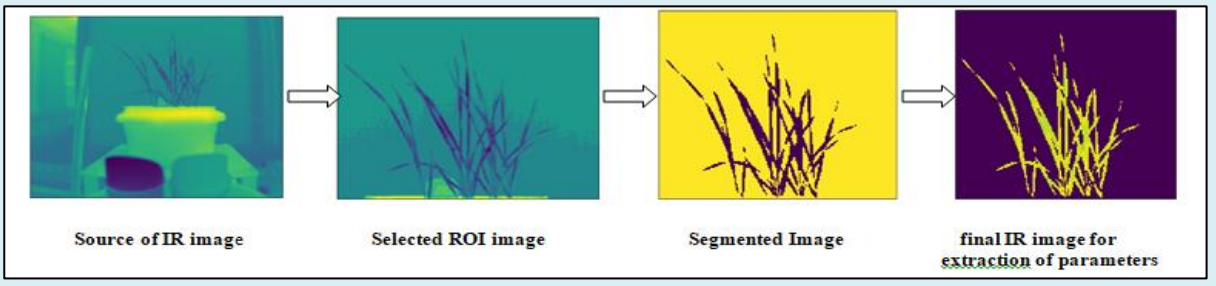
**PI:** Jagadish Rane; **Co-PI:** Mahesh Kumar

**Outputs**

- An algorithm was developed to study the genetic variation in crop plants based on thermal imaging parameters (i.e. CWSI, Relative stomatal conductance, canopy temperature etc).
- Results indicated that genetic variation can be recorded using this algorithm.
- This algorithm is now being validated for identification of drought tolerant genotypes of different crops.

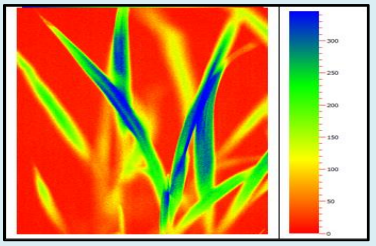
**Targets for next month**

- Initiation of experiment to characterize chickpea genotype.




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

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



Genotypic variation in chlorophyll fluroscence

**Outputs**

- Recording of chlorophyll fluorescence parameters in 5 promising Rice genotypes under depleting soil moisture and control condition.
- Variation of chlorophyll fluorescence parameter exists in rice genotypes under depleting soil moisture.

**Targets for next month**

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

## Monitoring Vineyard Canopy Management Using Images Acquired by UAV Platform

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

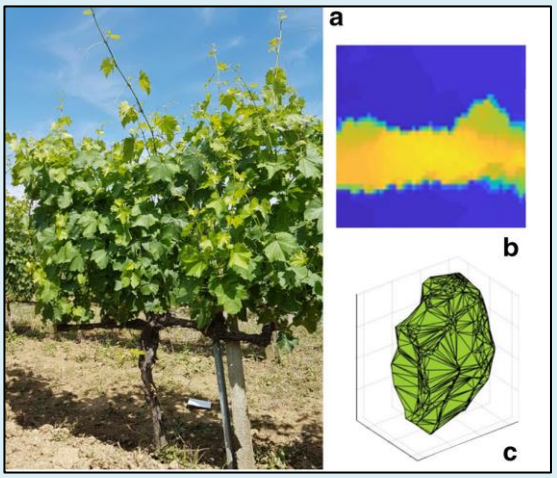



Fig. Data processing of sampled vines (a) using 2.5D (b) and 3D (c) methods (Di Gennaro and Matese 2020)

Canopy management operations, such as shoot thinning, leaf removal, and shoot trimming, are among the most relevant agricultural practices in viticulture. However, the supervision of these tasks demands a visual inspection of the whole vineyard, which is time-consuming and laborious. The use of images acquired with an Unmanned Aerial Vehicle (UAV) may prove to be an efficient way to measure woody crops canopy. López-Granados *et al*., 2020 demonstrated for the first time that a set of canopy management operations in agricultural fields can be evaluated through the use of photogrammetric point clouds. The use of UAV photogrammetry in combination with an automatic algorithm allows the detection and supervision of canopy management operations in vineyards in an efficient way, substituting the time-consuming field inspections. The results showed significant differences in the vine structure for the different treatments were detected in all the experiments using only the data from the flight after the management operations, and for pruning it was possible to establish a fixed threshold to detect trimmed vines considering only the data generated from the flight after the treatment. Comba *et al*., 2020 showed that estimation of LAI by processing dense 3D point clouds offers a viable and cost-effective alternative to traditional LAI assessments. The vineyard LAI estimated by the proposed methodology was correlated with the ones obtained by the traditional manual method ($R^2$=0.82). The proposed methodology allows for rapid, cost effective and extensive evaluation of the LAI in large vineyards with a degree of details comparable to the typical in-field operations of precision viticulture. It overcomes the limits of traditional LAI assessment methods, which are generally laborious and provide information within limited areas. The flexibility of UAV platforms can be used to estimate the LAI at the required time and growing periods, overcoming satellite imaging schedules.

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- Di Gennaro, S.F., Matese, A. 2020. Plant Methods 16, 91. (doi:10.1186/s13007-020-00632-2)
- López-Granados, F.; Torres-Sánchez, J.; Jiménez-Brenes, F.M.; Oneka, O.; Marín, D.; Loidi, M.; de Castro, A.I.; Santesteban, L.G. 2020. Remote Sens. 12, 2331. (doi:10.3390/rs12142331)


Di Gennaro and Matese 2020 described a rapid and objective tool for the farmer to promptly identify canopy management strategies and drive replanting decisions. The 2.5D method led to an overestimation since it is derived by considering the vine as rectangular cuboid form. On the contrary, the 3D method provided more accurate results as a consequence of the alpha-shape algorithm, which is capable to detect each single shoot and holes within the canopy. The 3D approach provided results closer to real canopy volume and higher performance in missing plant detection.

## A leaf from history: GIFT Tilapia: Food fish of 21st century

*Mukesh Bhendarkar and Manoj Brahmane*

Features of Gift Tilapia Fish

- high tolerance to variable water quality and climate
- salinity tolerance
- good disease resistance
- low feed conversion and feed efficiency.
- flesh characteristics and taste
- shorter harvest time; more than 200 gm can be sell
- high stocking density & resistance to diseases
- faster growth rate than any other fishes

Fisheries and Aquaculture is one of the fastest-growing food production sector globally, providing cheapest and most easily digestible animal protein. FAO estimated that by 2030, aquaculture production will grow by 40% to satisfy global fish demand. However, in India aquaculture is mostly restricted to carp farming and to some extent Pangasius culture.

There is urgent need to adopt high tolerant, faster growing, short culture period, hardier and more disease resistant fish which will benefits for small scale farmers in India. They allow farmers a greater per unit return on their investment and resources. Genetically Improved Farmed Tilapia (GIFT) is an ideal candidate playing an important role in blue revolution and will continue to do so in the future. It can be grown in diverse farming systems with faster growth rates, higher survival rates, wide feeding habits, resistance to diseases and a shorter harvest time, these unique attributes make it an extremely popular food source in Asia.GIFT has been developed from selective breeding of the species Nile Tilapia, Oreochromis niloticus which is also called as Super Tilapia. The GIFT is the producer of the world's first selective breeding program for tropical fish and is an important progressive event in fisheries history. GIFT Tilapia has been developed as a part of a leading selective breeding program that began in 1988 to adapt to a rapidly growing and changing environment.

Today, GIFT Tilapia is produced in at least 14 countries. Tilapia is considered the 'Food Fish' of the 21st century and is also popularly known as 'aquatic chicken'. The world production of tilapia is 4.0 million tons and its estimated value is 3.0 billion. According to the FAO report, global production of tilapia will reach 7.3 million tons by 2030. Tilapia has made significant contributions to food security in China, Egypt, the Philippines, Brazil, Thailand and Bangladesh. Tilapia is one of the surest fish species that can secure its place as an alternative to food security, especially for a growing population and cheap protein. GIFT tilapia has been improving for almost 30 years and is still improving. Given the current and potential contribution of GIFT Tilapia in fish production basket, there is no doubt that GIFT Tilapia can truly be a gift for aquaculture.

***"The difference between what we do and what we are capable of doing would suffice to solve most of the world's problems".***

***-Mahatma Gandhi***