फरवरी / February 2022

Issue

24

भाकृअनुप
ICAR

राअस्ट्रैप्रसं
NIASM

FARM COORDINATOR

... कृषि तकनीकी समन्वय पत्र

भाकृअनुप – राष्ट्रीय अजैविक स्ट्रैस प्रबंधन संस्थान

ICAR-NATIONAL INSTITUTE OF ABIOTIC STRESS MANAGEMENT

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Contents

FARM COORDINATOR

... कृषि तकनीकी समन्वय पत्र

भाकृअनुप ICAR

राअस्ट्रैप्रसं NIASM

February 2022 | Issue-24 | Page 1

निदेशक के लेखनी से...

आईसीएआर-नियासम, बारामती, पुणे का 41 हेक्टेयर के क्षेत्र में फैला हुआ अनुसंधान प्रक्षेत्र, अपने विकास, योजना और रखरखाव की दृष्टि से अद्वितीय है। प्रक्षेत्र अर्ध-शुष्क क्षेत्रों के लिए उपयुक्त अत्याधुनिक मिट्टी और जल संरक्षण प्रौद्योगिकियों को प्रदर्शित करता है। कृषि में अजैविक तनाव प्रबंधन के बारे में बहुमूल्य जानकारी उत्पन्न करने वाले सभी प्रयोग सुनियोजित और अच्छी तरह से बनाए गए हैं। इस उपलब्धि के पीछे अनुसंधान प्रक्षेत्र प्रबंधन प्रमुख कारक है, जिसके लिए वैज्ञानिक, तकनीकी और प्रशासनिक कर्मचारियों के बीच बेहतर समन्वय की आवश्यकता होती है। इसी को ध्यान में रखते हुए इस समन्वय को समृद्ध बनाने के उद्देश्य से 21 फरवरी, 2020 को 'फार्म समन्वयक' की शुरुआत की गई।

यह प्रकाशन पिछले महीने की उपलब्धियों और आगामी महीने के लिए कार्य योजना के बारे में विस्तृत जानकारी प्रदान करता है। कार्य की योजना बनाते समय फसल प्रबंधन और समग्र अनुसंधान फार्म प्रबंधन में तकनीकी हस्तक्षेप के पीछे का ज्ञान अनिवार्य है। यहीं पर यह प्रकाशन 'माह के लिए तकनीकी मूल बातें' इस शीर्षक के तहत पिछले दो वर्षों से महत्वपूर्ण भूमिका निभा रहा है। इस अवधि के दौरान 'अनुसंधान प्रक्षेत्र प्रबंधन' में कई उल्लेखनीय सुधारों का अनुभव किया गया है। यह विशेष अंक महत्वपूर्ण उपलब्धियों के साथ-साथ तकनीकी बुनियादी बातों पर चुनिंदा जानकारी पर केंद्रित है। फार्म प्रबंधन एक सतत प्रक्रिया है और कई सारी गतिविधियां नजर में हैं। 'फार्म कोऑर्डिनेटर' के तहत प्रतिदिन छोटे-छोटे सकारात्मक परिवर्तन के महत्वपूर्ण विचार को उत्तरोत्तर घटित होते देखा जा सकता है।

डॉ. प्रविण भिमदेव तावरे और उनके सहयोगियों को इस प्रकाशन को प्रकाशित करने और खेत में कई नवाचारों को आजमाने में उनके समर्पण और निरंतरता के लिए मैं धन्यवाद देता हूं। मुझे पूरी उम्मीद है कि इस टीम और आईसीएआर-नियासम के सभी कर्मचारियों के प्रयासों से अनुसंधान फार्म के प्रबंधन में सुधार होगा और इसे कहीं और दोहराने के लिए एक मॉडल फार्म बनाया जाएगा।।

From Director's Desk...

The research farm of ICAR-NIASM, Baramati, Pune, spreading over an area of 41 ha, is unique from the point of its development, layout and maintenance. The farm demonstrates state-of-the-art soil and water conservation technologies suitable for semi-arid regions. All the experiments are well-planned and nicely maintained generating valuable information about abiotic stress management in agriculture. Research Farm Management is the key factor behind this accomplishment which requires better coordination among the scientists, technical and administrative staff. Keeping this in view, Farm Coordinator was initiated on February 21, 2020 with the aim of enriching this coordination.

This publication provides detailed information regarding achievements of the preceding month and plan of action for the upcoming month. While planning work the knowledge behind technical interventions in crop management and overall research farm management is mandatory. That is where this publication is playing significant role since last two years under the title 'Technical Basics for Month'. Several noticeable improvements in 'Research Farm Management' have been experienced during this period. This special issue focuses on significant achievements as well as selective information on technical basics. Farm management is a continuous process and lot many activities are in focus. The idea of small positive change every day behind 'Farm Coordinator' can be seen happening progressively.

I thank Dr. Pravin Bhimdeo Taware and his team for their dedication and sincerity in bringing out this publication and trying out several innovations in the farm. I sincerely hope that the efforts of the team and all staff of ICAR-NIASM will improve the management of research farm and make it a model farm to be replicated elsewhere.

फरवरी / February 21, 2022

हिमांशु पाठक / Himanshu Pathak

Model Research Farm Development

NIASM, the unique institute of ICAR, was set up on 21 February, 2009 at Baramati representing the rain shadow area after the Sahyadri Ranges frequented by famine calamities. The 56.5 ha of barren land allotted to the institute was having shallow 0.1–0.3 m murrum soil with parental basaltic rock. With the objective of developing a "Model Research Farm" for demonstrating soil and water conservation technologies and for multi-disciplinary and multi-commodity basic and strategic research on abiotic stressors, the work started with a generation of a contour map. The land has relatively steeper slopes (4%) towards east from the central peak while it is sloping gently (1.8%) towards south. Since there was hardly any soil on the surface, the land development presented a gigantic challenge.

The research farm was designed for an area of 41 ha based on scientific considerations like watersheds, natural drainage pattern, topography, contour map and layout of various buildings etc. The south side farm (16 ha) is divided into six blocks which are sub-divided into 37 rectangular/trapezoidal plots including agro-met observatory and fish ponds. Since the acquired land was a rocky (basalt) terrain devoid of any vegetation, this was blasted, ripped and levelled with the help of heavy machinery. Locally available spent wash was applied to further pulverize the gravelly murrum. Since the virgin soils were still gravelly and low in fertility (OC 0.07%; Av-P 0.5 kg/ha), heavy additions (30-40 brass/acre) of spent mushroom substrate/ FYM were made. In addition, 4.25 ha area has been filled-in by transporting black/ tank silt soil. North-east side farm (8 ha; initially 4% slope) has been developed into three blocks of five terraces (width 35-38 m) while 4 ha of north-west side farm including a water balancing tank has been developed into two blocks having 7 research plots. Research activities to evolve long lasting solutions for the adverse impacts of abiotic stresses on crop production, livestock and fisheries have been initiated on south-farm. Both the northeast and north-west farms have been put under orchards to address edaphic stress and drought related issues.

.Satellite image of site 2009

.Satellite image of site 2021.

Irrigation Facility: There is ground water available for use at campus. The only source of irrigation water is Nira canal from where water is lifted to farm ponds at campus viz., Malhar and Manas ponds. Earlier flood irrigation was being implemented for field crops but now most of the fields have micro-irrigation facility. Orchards and landscape garden plantations are also having drip and sprinkler options for irrigation. Whole irrigation system is controlled form central automated irrigation and fertigation system located near Manas pond.

Schematic layout of Farm: The master plan of the institute envisaged a "Model Research Farm" spread over an area of 41 ha for demonstrating soil and water conservation technologies suited to the semiarid climate of the region. The satellite image (2009) of the institute site i.e. before the initiation of developmental activities depicts that its land was lying as a barren patch as distinguished from the surrounding green agricultural fields. Last google imagery (2021) depicts the changed picture of the farm while Fig. 1 illustrates the farm layout.

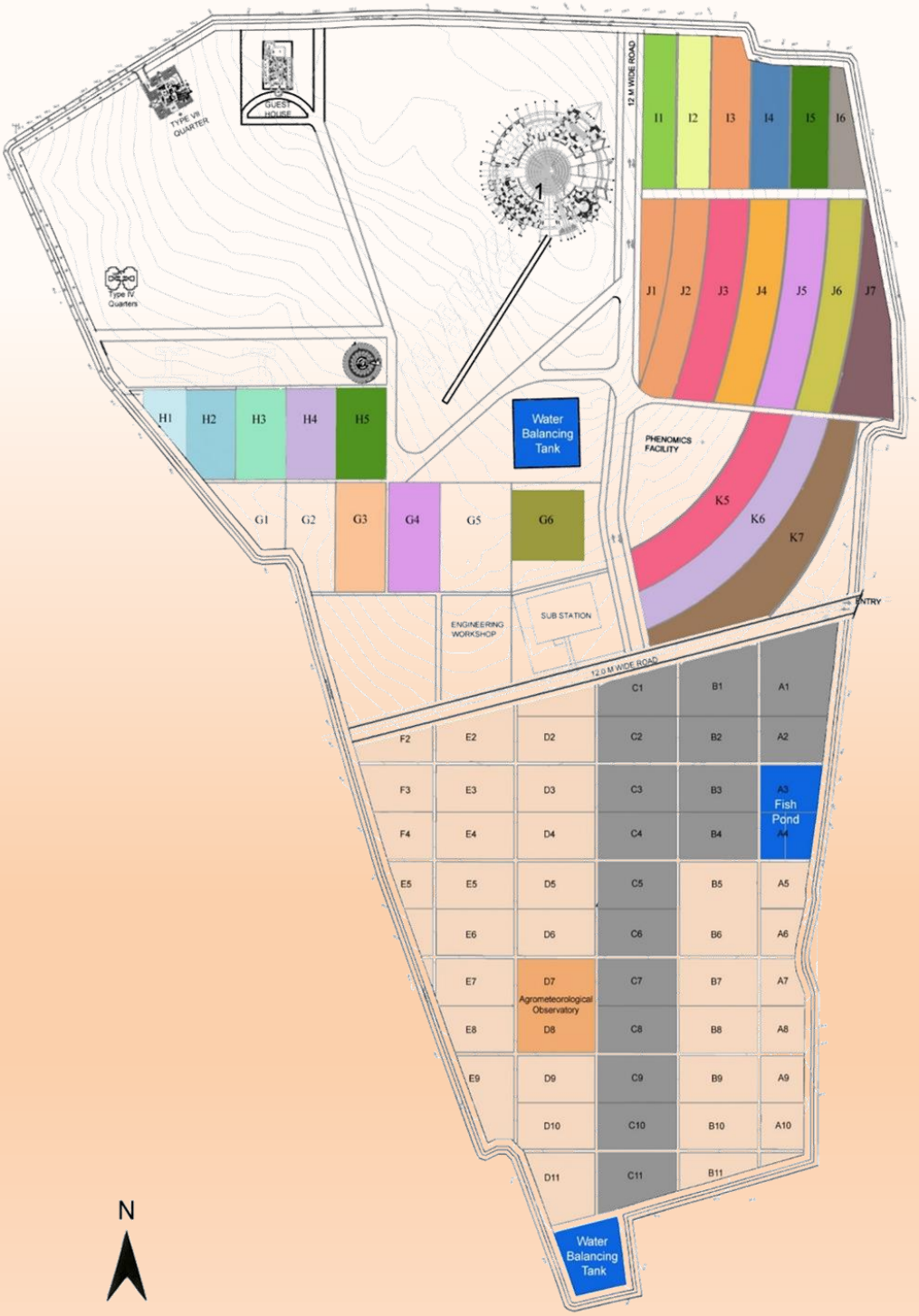


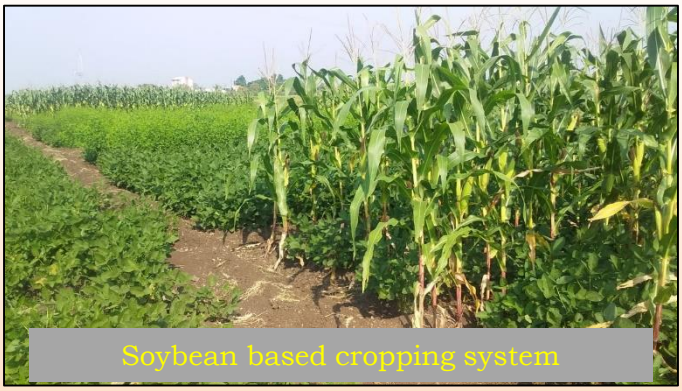
Fig. 1 Schematic Layout of ICAR-NIASM Model Research Farm


Mung bean field


Soybean bumper crop


Wheat at grain filling stage

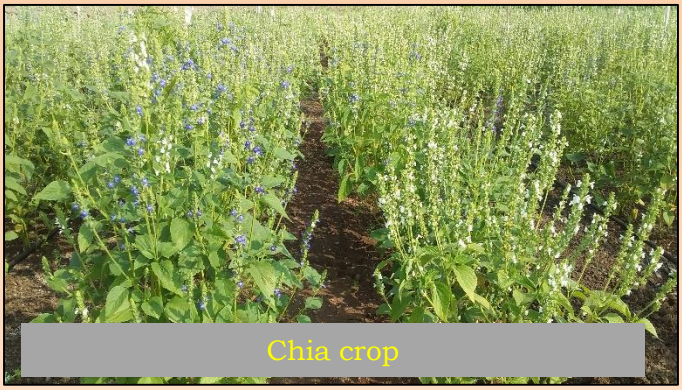

Rabi Jowar


Soybean based cropping system


Mixed vegetables on drip


Sugarcnae crop growth


Onion research


Chia crop


Quinoa crop

The research farm of ICAR-NIASM, Baramati, spreading over an area of 41 ha, is unique from the point of its development, layout and maintenance. The farm demonstrates soil and water conservation technologies suitable for semi-arid regions. The farm is divided into two blocks i.e., South Block with 37 fields to study the impact of abiotic stresses on crop production, livestock and fisheries and their mitigation strategies and the North Block with 19 terrace fields demonstrating planting techniques, soil mixtures and irrigation techniques for profitability and sustainability of orchards on basaltic-murum soils. All the experiments are well-planned and nicely maintained generating valuable information about abiotic stress management in agriculture. Research Farm Management is the key factor behind this accomplishment which requires better coordination among the scientists, technical and administrative staff. Keeping this in view, Farm Coordinator was initiated on February 21, 2020 with the aim of enriching this coordination. The publication provides detailed information regarding works done during the last month and plan of work for the upcoming month. Several improvements have been reported in the 'Research Farm Management', and significant achievements especially during last two years are as follows;

- Malhar Pond
- Lift Irrigation and Micro-irrigation Expansion
- Naxatra Udyan
- QR NIASM
- Actions to Facilitate AGRI-Tourism
- Malad Farm Developments

Publication of 1st issue of 'Farm Coordinator'

Malhar Pond

'Malhar pond', a water balancing cum storage tank is the most needed basic facility located at south-west corner of NIASM campus. The concept was approved in April 2020 to fulfill immediate need for balancing tank to install pumping facilities in new lift irrigation project. The second phase was approved in February 2021 and completed in early June 2021. Following are the details of the photographic illustrations of this development.

- **Original site**: It is the original site seen as a depression of 2 to 3-meter depth with a weathered rock debris inside. During the development of campus, it was decided to construct water tank at this spot but anyhow it could not be implemented. While preparing roads in the campus, some murum material required for filling was dug out from this area. Looking in to all these facts, this site was proposed for building a water storage tank. Initially it was to be made of concrete but the concept lagged behind due huge cost. Therefore, it was proposed in April 2020 to make it lined with HDPE geo-membrane that to in two phases (Fig. 1).
- **Whole Pond view**: This picture shows the pond completed through two phases, filled with water and named as '*Malhar*'.

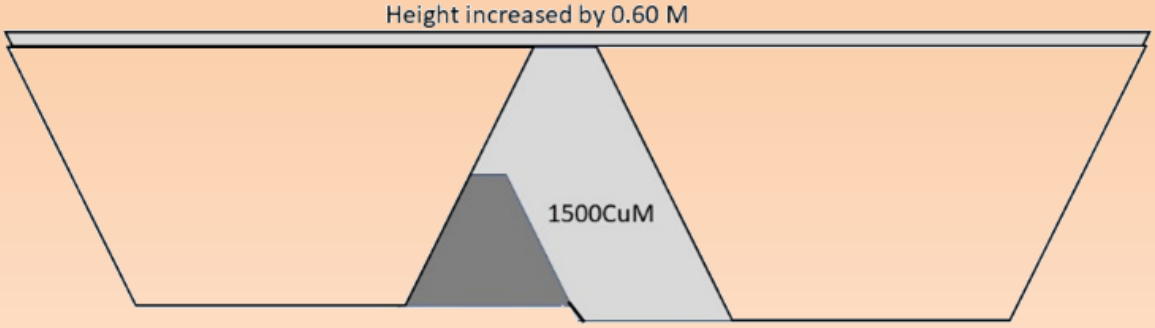


Fig. 1 Illustration of 'Malhar Pond' development in two phases.

- The pond development was carried out in two phases as illustrated in the diagram. The first phase was completed in May to July 2020 while second phase completed during Mar to June 2021. Initially both the ponds were going to be separate ponds but it was decided to keep the height of dividing bund of the height 1.75M that is going to remain submerged as water level rises above it. This structure is going to help in operation and maintenance of ponds without interrupting water supply at any given time.
- This picture shows already commissioned first phase and plastic lining work of second phase completed on June 9, 2021. The water filling was continued overnight so as to enter second phase.
- As water entered the second phase of the pond it was celebrated with 'Jal Poojan' with the hands of Dr. Himanshu Pathak, Director, ICAR-NIASM at 10.10 am on June 10, 2021. Dr. Jagadish Rane, Chairman, Farm Advisory Committee was also present for this small event. It really an overwhelming and emotional celebration of a 'Dream come true' for all the farm team.


Original Site


First page starting ritual


Secon phase completed


Jal Poojan on completion

Malhar Pond View

QR_NIASM to Explore the Facilities and Activities of the Institute

Introduction:

- 'QR-NIASM' App, the first of its kind, acts as a personal guide for Android users for effective and easy access to information of the Institute.
- The user can scan the QR code on the nearby display board and get the desired information in audio format in Marathi, Hindi and English languages, as per the choice.
- Within this App, the user will get access to various Audio Books published by this institute, in trilingual format.

Data collection and management:

1. For creation of database, the technical information related to the infrastructures, research projects and other services is being collected, edited and recorded in MP3 format. All data is stored on institute's server.
2. An app for Android users has been developed by using Android Studio. It supports all devices with Android API level above 21.
3. Generation of QR Codes was carried out using Python 3.8.

Procedure to download an App:

1. App can be downloaded through link- http://niam.res.in/QR_NIASM/
2. Or by searching NIASM on Google Play Store and install app first in list.

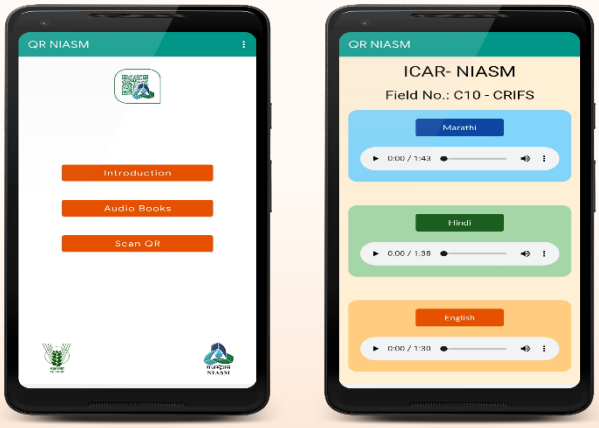
Sample QR codes & demonstration

Four sample QR codes to demonstrate its working through 'QR_NIASM'. Just scan the codes through App and get desired information. These QR codes linked to the information about Fishery Wet Lab-1 (Field A-5), Conservation Agriculture Project (Field B-1), Climate Resilient Integrated Farming System (Field C-10) and Agro Meteorology Observatory (Field D-7).

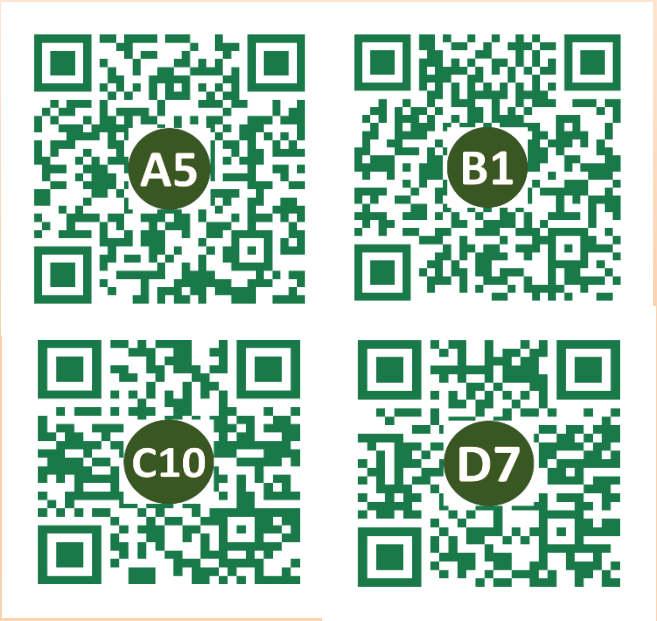
QR_NIASM Concept Launch

Specialities of the App:

- Dedicated scanner- the inbuilt scanner is restricted for reading NIASM QR codes only. Other codes will be disregarded providing cyber safety.
- After scanning QR code if connection to server is unavailable due to bandwidth issues, the code could be retrieved from scan history to get information as soon as the issue resolves. This feature will help during time limitations too.
- With this App there is easy access to the 'Audio Books' through the smart phone, so as to hear them during available spare time.



An interface of the App QR_NIASM



Sample QR Codes for demonstration through QR_NIASM

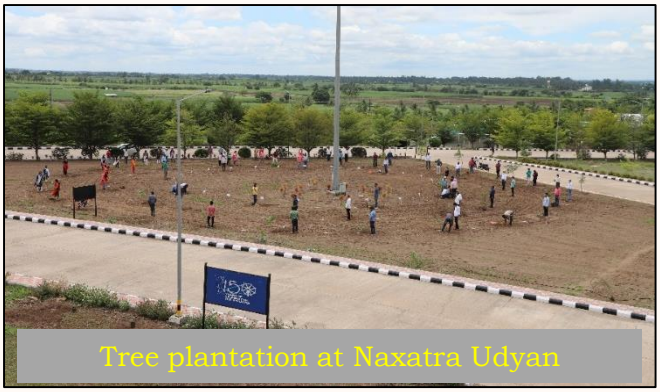
Developers:

Pravin B. Taware, Pravin H. More, Shon P. Taware and Bhaskar B. Gaikwad

Naxatra Udyan (The Constellation Park)

On the eve of ICAR Foundation Day on July 16, 2021 a Naxatra Udyan (Constellation Park) was established as a 'Tree Plantation' programme at ICAR-NIASM campus. 42 different species of plants representing 27 Naxatras were planted in the central triangle of the Institute. All the staff members including Scientists, Technical, Administration and Associate staff participated in the programme. Dr Himanshu Pathak, Director, inaugurated the establishment of 'Naxatra Udyan' by planting Vat-vriksha i.e., '*Ficus religosa*' plant.

Naxatra Udyan inaguration


Tree plantation at Naxatra Udyan

The concept of Naxatra Udyan is basically for biodiversity conservation. There are lot many trees/ plants that are not much familiar as not been grown commonly and may become instinct in future. Therefore, arrangement has been made through vedic culture for conservation of such species by assigning them to specific zodiac positions. As the earth orbits around sun, virtually various changes in appearance of star positions can be seen from earth. The arrangement of some of these stars is presumed to have appearance resembling common living or material things; named accordingly. The 360° sky positions are divided into 27 equal parts and are named by the star arrangement in specific location. Therefore, there are 27 Naxatras (constellation) through which the sun and the moon seem to be passing through during their virtual movements around earth. Each constellation is then supposed to have an effect on certain plant species, out of which two for each have been selected for planting is this park. The plantation is arranged in three circles of 42 m, 33 m and 24 m diameter. Outer circle is having 27 main deity plants assigned to specific Naxatra, the middle and inner one has 18 and 9 secondary plants, respectively, totaling 54 plants. These plants represent 42 different species. It is supposed that one must try to conserve plant representing their Naxatra decided on the basis of birth time and place. Instead of taking this as a superstition, one must consider this an arrangement for biodiversity conservation.

List of plant species in Naxtra Udyan:

Golden shower (Cassia fistula), Kuchala (*Strychnos nux-vomica*), Vasaka (*Justicia adhatoda*), Amla (*Emblica officinalis*), Cutch tree (*Acacia catechu*), Cluster fig (*Ficus racemosa*), Baheda (*Terminelia bellirica*), Jamun (*Syzigium cumini*), Stone-apple (*Aegle marmelos*), Sacred fig (*Ficus religiosa*), Agar wood (*Aquilaria agallocha*), Sandalwood (*Santalum album*), Bamboo (*Dendrocalamus strictus*), Banyan tree (*Ficus bengalensis*), Flame of forest (*Butea monospema*), Juhi (*Jasminum auriculatum*), Beaty leaf (*Calophyllum inophyllum*), Washnut (*Sapindus mukorossi*), Payar peepal (*Ficus rumphii*), Arjuna (*Terminelia arjuna*), Jasmine (*Jasminum grandiflorum*), Bullet wood (*Mimusops elengi*), Red cotton tree (*Bombax ceiba*), Nagkesar (*Messua ferrea*), Night Jasmine (Nyctanthes arbourstritis), Lodhra (*Symplocos racemosa*), White damar (*Vateria indica*), Rattan cane (*Calamus rotang*), Ashoka (*Saraca indica*), Jack fruit (*Artocarpus heterophyllus*), Camel's foot (*Bahunia variegata*), Mango (*Mangifera indica*), Neem (*Azadiracta indica*), Burflower tree (*Mitragyana parvifolia*), Sonpatta (*Bahunia racemosa*), Hirda (*Terminelia chebula*). Moha (*Madhuka indica*), Tamarind (*Tamarindus indica*), etc.

Rabi crops' maintenance: Sowing in all experimental fields will be completed by the first week. Maintenance of all these will be given priority for weed management, irrigation and plant protection. Layouts for micro-irrigation will be finalized to bring maximum fields under drip or sprinkler.

Orchard management practices: Due care of pomegranate and grape orchards that are in fruiting phase will be taken up for canopy management, nutrition, plant protection and irrigation. Sweet orange fruiting season will be over in next month and will be left on stress for some period as a part of bahar treatment. Dragon fruit training for opening up the canopy is in progress. It will be kept in stress for about a month and trials on advancing fruiting season will be started thereafter. All other orchards like guava, fig, mango, acid lime in resting phase will be managed through application of manure and fertilizers for improving performance.

Malad farm activities: Maintenance of crops sown during rabi season will be the first priority. *Prosophis* shrubs in 2-3 remaining fields, road spaces and bunds to be removed for easy access in all the fields.

Plant protection: Due to prolonged rains as effect of cyclone, disease load in orchards have been increased. Prophylactic sprays for control of anthracnose, downy mildew and powdery mildew in grape, leaf spot in pomegranate are required during next month. Use of sticky traps, clean cultivation and sprays for sucking pest management are required at early stages. Preparations for mango flowering to be made by protecting foliage with pesticide sprays. Prophylactic spraying of pesticides will be carried out in dragon fruit to avoid infections through wound after pruning.

Weed management and waste disposal: This activity is a big issue due to intermittent rains and increased workload of sowing and orchard management activities. Integrated weed management has to be followed by use of machinery (mulcher, rotavator, and brush cutter), manual weeding and use of non-selective herbicides in open areas. The diseased biomass was disposed of by burning while other material need to be shredded and spread in orchards for in-situ decomposition.


Training in tomato crop


Fodder maize drip irrigation


Pruning in Sweet orange


Back pruning in Apple-ber


Mangi flowering delayed this year


Karonda


Sweet orange


Guava


Grape


Custard apple


Amla


Drumstick


Apple-Ber


Date palm


Dragon fruit

Variation in climatic features at ICAR-NIASM

Mr. Sunil Potekar. Sr. Tech. Asst. (Agro. MET)

Agriculture is sensitive to short-term changes in weather and to seasonal, annual and longer-term variations in climate. The variations in the meteorological parameters are more of transitory in nature and have paramount influence on the agricultural systems. Weather conditions during crop seasons strongly influence the crop growth and development. The climate regulates and the weather determines the growth and development and finally the yield of the crop. It is therefore; necessary to measure the meteorological parameters in all agricultural experimental stations. The interpretation of experimental results in the light of weather conditions prevailing during the period of crop growth is important. In addition, any weather abnormalities such as cyclones, floods, droughts, hailstorms, frost, high winds and extreme temperatures impact agricultural productivity and cause associated adverse effects on socio-economic conditions.

About the Agro-MET Observatory at ICAR-NIASM Campus: Initiation of weather observations within the ICAR-NIASM began from January, 2012 with the establishment of an automatic weather station (AWS). It is located in the midst of the agricultural farm situated in the southern side (Latitude: 18º 09'30.62"N Longitude: 74º 30' 03.08"E Altitude: 550 m AMSL). The systematic observations using IMD's prescribed criteria for class-II Agromet observatory could be started only after October, 2013. Since then the weather observatory at NIASM is functioning full-fledged with standard Agromet instruments to cater to the scientific needs of the Institute.

This observatory is class-II type wherein temperatures are recorded mandatorily twice daily at 0700 & 1400 LMT (Local Mean Time) whereas rainfall and evaporation at least once daily at 0830 IST (Indian Standard Time). Daily data records are available for the variables, viz. the maximum and minimum temperature, morning and afternoon relative humidity, wind speed and rainfall from Jan 2012 to Dec 2021 while for wind direction, soil temperature, bright sunshine hours, pan evaporation, and dew observation it is corresponding to the period Jan 2014 to Dec 2021. The daily, weekly, monthly, seasonal and annual weather data are presented along with the entire statistical parameters viz. mean, lowest and highest values.

Fig 1 Agrometeorological Observatory (Class-II) at ICAR-NIASM

Characteristics of weather parameters:

Statistics with respect to weather variables, viz. the maximum and minimum temperature, morning and afternoon relative humidity, wind speed, wind direction, soil temperature, no. of bright sunshine hours, pan evaporation, rainfall based on daily records are described below

1. Temperature: Long term annual daily mean, maximum and minimum temperatures for this location are 26.2, 33.2 and 19.1 °C, respectively. During last 10 years (2012-2021), daily annual mean temperature at NIASM, Malegaon stood at 25.7°C and varied between 25.0 °C and 26.3°C. The annual mean daily minimum temperature during ten years showed a range of about 1.2 °C, fluctuating between 18.3 °C and 19.5 °C whereas, the mean annual maximum temperature ranged between 31.7 °C and 33.0 °C *i.e.* a difference of 2.3 °C. Monthly mean temperature varied between 21.4 °C (January) and 30.6 °C (May) (Fig.2). Monthly maximum temperature reached its peak in April (38.5 °C) and dipped to 29.4 °C in December. For minimum temperature, May records the highest (22.8 °C) and January the lowest value (13.1°C).

Daily maximum temperature has reached up to 42.8 °C (27 April 2019) while lowest daily minimum temperature dipped up to 5.7 °C (29 Dec 2018).

2. Relative humidity: Relative humidity measured at the standard hours in the morning (RH I) and afternoon (RH II) during the period 2012 and 2021 were used for computation of monthly statistics. RH I varied between 62 per cent (March) and 90 per cent (September). On the other hand, variation in RH II was between 18 (April) and 64 per cent (July) (Fig.2). Annual mean for the daily average RH stood at 59 per cent. Higher diurnal ranges in RH were observed in the months of January, February and December when it was more than 45 %. Lowest diurnal range was observed in the month of July (24 %) followed by August (27 %). Other months that showed a diurnal range (>30 %).

3. Rainfall: With respect to rainfall, long term average (LTA) for the period of 1992 to 2021 of this locality for the year is only 597 mm of which about 70 and 22 per cent occurs during southwest monsoon (June-September) and post-monsoon (October-December) period, respectively. Annual and seasonal rainfall averaged 584 mm and 388 mm for the period 2012-2021 and occurred 98% and 95% of the normal respectively. The maximum annual rainfall was received in year 2020 (1017 mm) followed by 2014 and 2017 (760 mm each) while lowest rainfall was received in year 2012 (289 mm) followed by 2018 (351 mm) (Fig. 3).

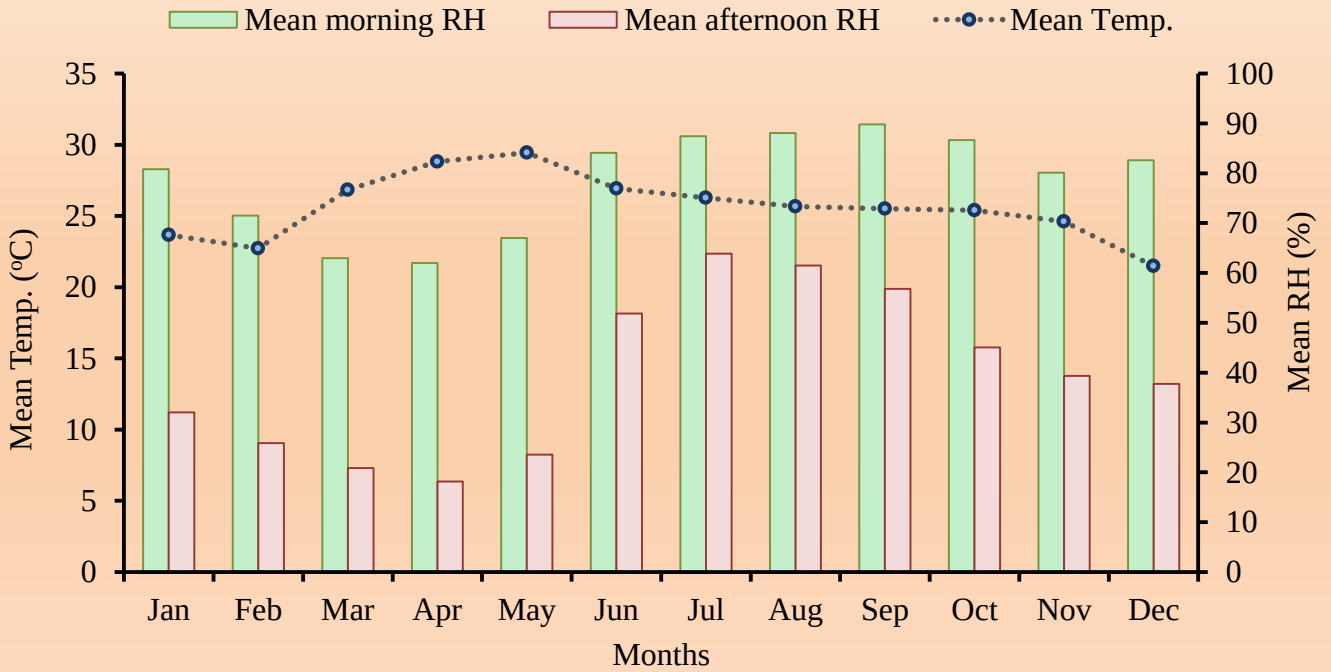


Fig 2. Variations of monthly mean temperature, mean morning and afternoon relative humidity at ICAR-NIASM Baramati (2012-2021).

The rain mainly commences from second week of June and withdraws from last week of September to second week of October. With respect to decade (2012-2021), in the monsoon season, the maximum rainfall received normally during September (160.3 mm) followed by June (96.8 mm) (Fig. 3). In the post-monsoon season, highest rainfall normally occurs in October (115.4 mm) followed by November (12.9 mm) and during the summer season in May (26.2 mm). Average rainfall for July and August was 74.8 mm and 56.3 mm, respectively. Other months of the year, *viz.* December, January, February, March and April received average rainfall < 20 mm. The variability in rainfall during south-west and the post-monsoon season is 45 and 84 per cent, respectively while the CV is 39 per cent for the annual rainfall. Effective rainfall is received only during the period May-October.

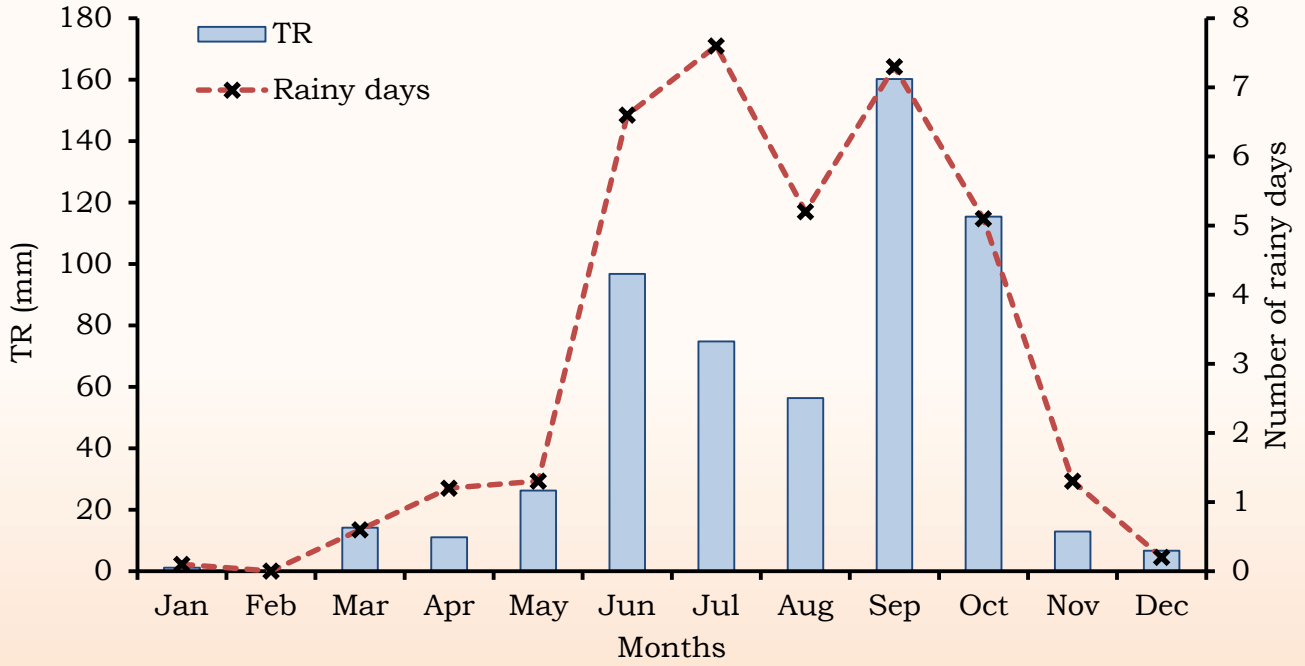


Fig 3. Variations of annual total rainfall (TR) and number of rainy days at ICAR-NIASM Baramati (2012-2021).

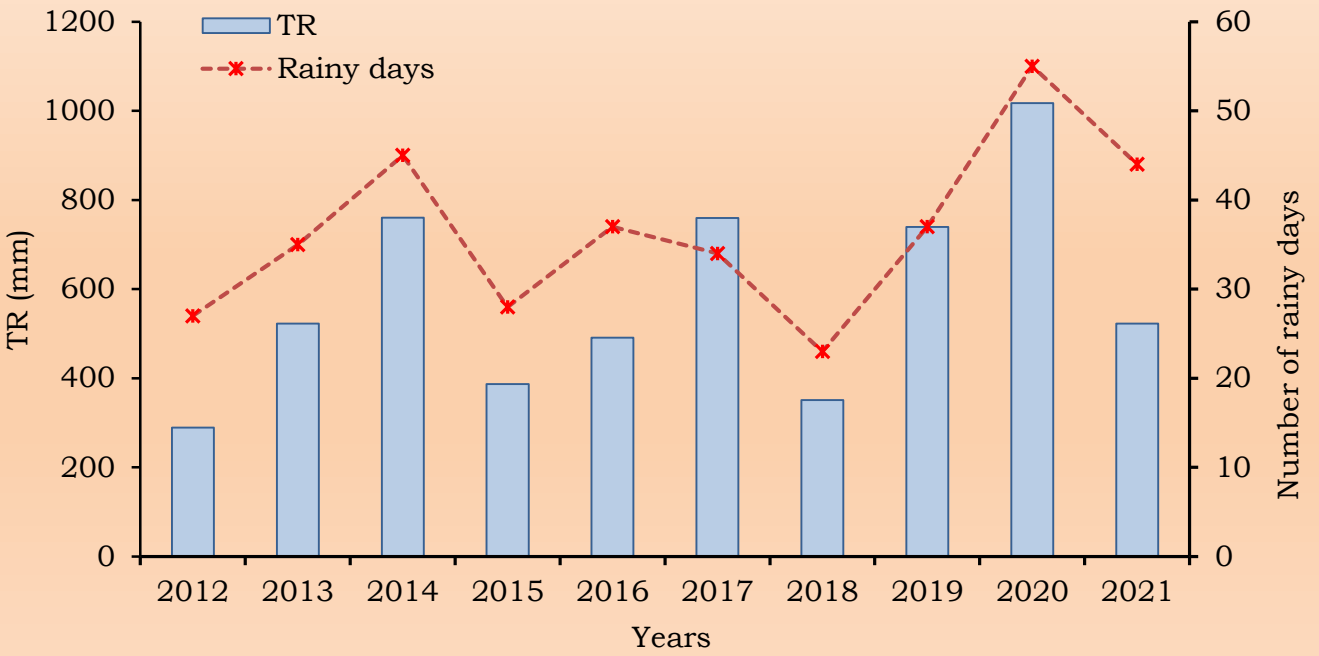


Fig 4. Variations of monthly total rainfall (TR) and number of rainy days at ICAR-NIASM Baramati (2012-2021).

4. Wind: During last ten years (2012-2021), annual daily average wind speed stood at 7.5 $kmhr^{-1}$ and varied between 4.4 and 11.5 $kmhr^{-1}$. During the year, monthly average values have been found to vary between 4.7 (December) and 12.1 Km h^{-1} (July). Daily maximum wind velocity has reached up to 31.0 $kmhr^{-1}$ (19 June 2012) while lowest daily minimum wind velocity was recorded 1.5 $kmhr^{-1}$ on 6 Jan 2016, 2 Dec 2016 and 23 Dec 2016. Average wind speed showed a consistently increasing trend during January to June- July and a consistent decreasing trend during July to December. It is relatively low in the months November and December (Fig 5).

During morning hours (0700 LMT) wind blew mostly from two prominent sectors, *viz.* south-west to west and west to north-west directions On the other hand, wind directions showed higher variability during the afternoon observations at 1400 LMT and prominent directions were south-east, west of south-west, north-east and west.

5. Evaporation: Annual average Class A open pan evaporation (Pan-E) aggregates to 2156.2 mm which is about 3 times the rainfall. During the period between Jan, 2014 to December, 2021, open pan evaporation (Pan-E) varied between 3.8 mmd^{-1} (December) and 10.5 mm d^{-1} (May) and the annual average of daily Pan-E was 5.9 mm. Monthly rate of Pan-E showed a consistently increasing trend during January and May and a consistent decreasing trend during October to December (Fig 5). During monsoon, in the months of June to September, pan evaporation fluctuated as per the prevailing radiation and cloud and rainfall situation. The highest daily pan evaporation was reported on 30th May 2019 (14.8 mm/d).

6. Sunshine duration During last eight years (2014-2021), annual mean daily bright sunshine duration was 6.6 hrs and varied between 5.8 and 7.1 hrs. During the year, monthly average values have been found to vary between 4.3 (July) and 9.1 (April) (Fig 5). Daily maximum bright sunshine duration has reached up to 11.5 hrs (24 April 2016).

7. Extreme weather events in the decade (2012-2021): The warmest and coldest days were obtained based on daily mean temperature data, and it was found that 27th Apr 2019 (35.0°C) and 29th Dec 2018 (16.0°C), were the warmest and coldest days respectively (Table 1). Daily maximum temperature reached up to 42.8°C (27th Apr 2019), while lowest daily minimum temperature dipped to 5.7 °C (29th Dec 2018). The warmest and coldest months were calculated based on monthly mean maximum and minimum temperatures, respectively. May 2013 (31.6°C) was the warmest and Dec 2014 along with Jan 2015 (20.1°C) were the coldest months during the decade (Table. 1). The cumulative monthly rainfall was highest in Oct 2020 (332.4 mm). The highest rainfall, pan evaporation and wind speed events were reported on 15th Oct (120.4 mm), 30th May 2019 (14.8 mm/d) and 19th Jun 2012 (31.0 kmph), respectively. The institute campus at Malegaon and areas around witnessed unprecedented hail storm on 9th Mar, 2014 for about half an hour with hail size of 2 - 3 cm.

Table.1. Important meteorological events

Particular of weather parameter	Value	Date
Highest daily mean temperature	35.0 °C	27 Apr 2019
Lowest daily mean temperature	16.0 °C	29 Dec 2018
Highest daily maximum temperature	42.8 °C	27 Apr 2019
Lowest daily minimum temperature	5.7 °C	29 Dec 2018
Highest monthly mean temperature	31.6 °C	May 2013
Lowest monthly mean temperature	20.1 °C	Dec 2014 & Jan 2015
Highest daily rainfall	120.4 mm	15 Oct 2020
Highest monthly cumulative rainfall	332.4 mm	Oct 2020
Highest monthly cumulative PE	376.3 mm	May 2019
Highest rate of daily PE	14.8 mm	30 May 2019
Highest daily wind speed	31.0 kmph	19 Jun 2012

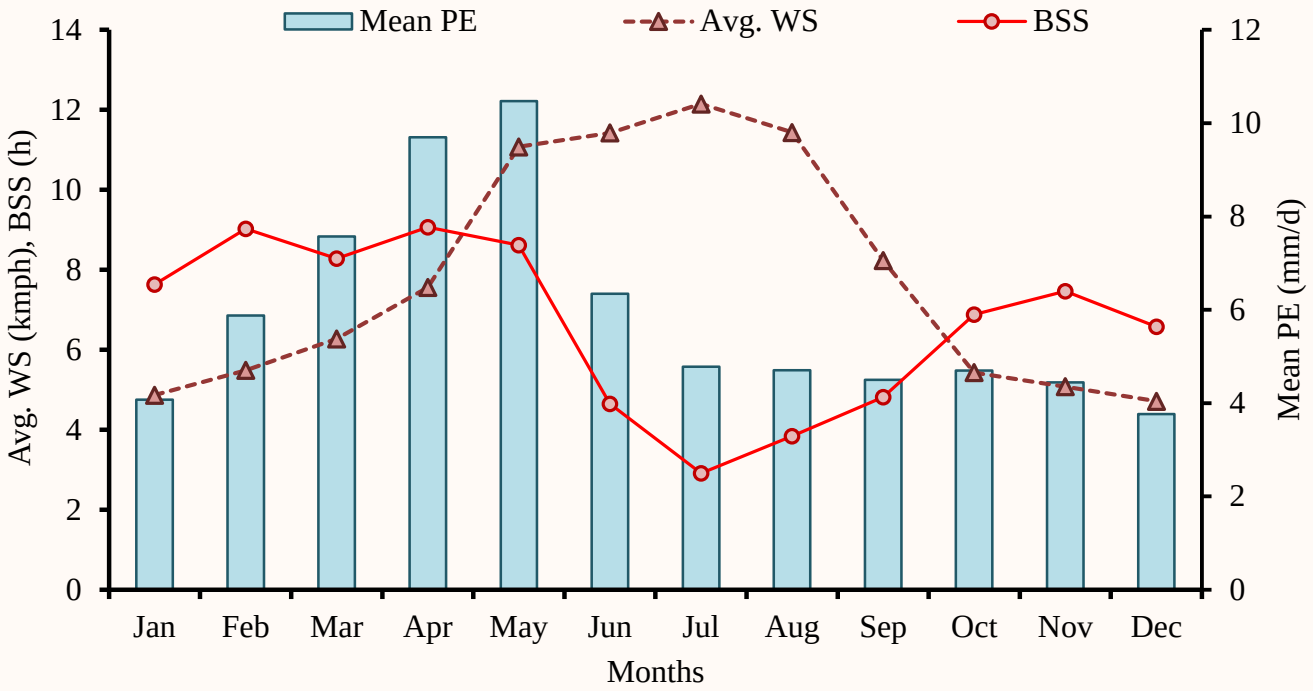


Fig 5. Variations of monthly mean pan evaporation (PE), average wind speed (WS) and mean bright sunshine hours (BSS) at ICAR-NIASM Baramati (2012-2021).


Tree plantation at Campus


Tree plantation at Malad Farm


Dragon Fruit Field Visit


Visit to Livestock Unit


Conservation Agriculture


Hydroponics Unit


Indoor Garden

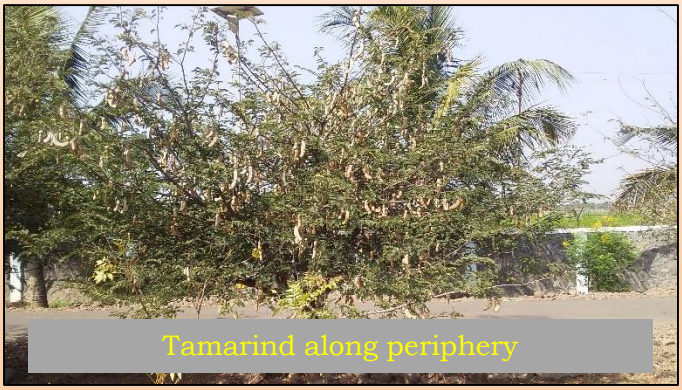

Indoor flowers


Peripheral Chafa


Peripheral Kanher


Bael fruits


Nursery plants


Tamarind along periphery


Coconut along periphery


Cactus collection


Medicinal Garden

Reducing nitrogen footprint in sugarcane cropping system

Dr. Aliza Pradhan, Scientist (Agronomy), ICAR-NIASM

Sugarcane is one of the most important cash crops in India, contributing to 25% of the world's production, next to Brazil and supporting over 6 million farmers and their families. Contribution of sugarcane to the national GDP is 1.1% which is significant considering that the crop is grown only in 2.57% of the gross cropped area. However, nitrogen (N) management is one of the critical aspects in sugarcane production, as very low can impact negatively on sucrose production, juice quality and very high can cause lodging, reduced cane quality and increased risk of pest and disease infestation. In general, a sugarcane crop having yield of 100 t ha^{-1} removes 207 kg N from the soil which differs depending on agro-ecosystems. For e.g. for Maharashtra, around 400 kg N ha^{-1} is recommended for sugarcane by agriculture University i.e. MPKV, Rahuri. Further, urea, being the major source of N fertilizer, has very low fertilizer use efficiency (only 20-40 per cent) which in turn leads to its large amount application in fields and subsequent loss to environment. The approach of nitrogen footprint (NF) is a useful tool to estimate the environmental impacts of N losses through the whole agro-food production chain. Nitrogen footprint in a cropping system is expressed as the whole quantity of reactive nitrogen released to the environment from losses associated with crop production and one of the common ways to reduce the NF is to improve the nitrogen use efficiency (NUE) which is calculated as ratio of nitrogen exported from field to crops to the amount of nitrogen applied. Therefore, suitable agricultural N management practices are needed for sustaining the productivity while reducing NF in sugarcane crop production.

Nitrogen is lost to environment in different forms viz., volatilization loss (N is lost in form of ammonia (NH_3) in high pH, increased soil temperature, high moisture and coarse texture soils); denitrification loss (in the form of N_2O in waterlogged soils, deficient in oxygen level); leaching loss (nitrate (NO_3^-) lost through high rainfall in coarse textured soils); along with runoff and soil erosion.

Different management strategies to improve the NUE in order to reduce nitrogen footprint in sugarcane production are discussed in Fig. 1. Thus, careful management practices coupled with newly developed technologies can increase the sustainability of sugarcane production system while reducing its nitrogen footprint on environment.

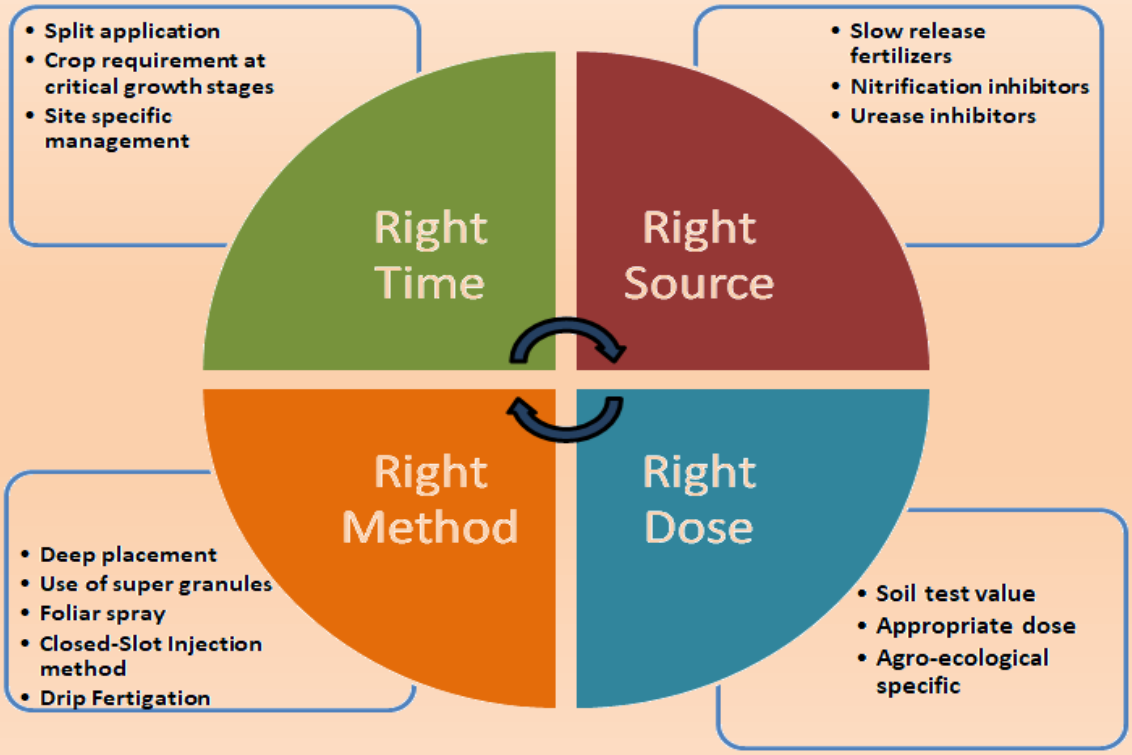


Fig 1. Strategies to reduce nitrogen footprint in sugarcane crop production

Bajra Napier Hybrid: High yielding fodder source for intensive livestock

Dr. Hanamant M. Halli, Dr. Sangram Chavan, Dr. S. A. Kochewad and Dr. A. V. Nirmale

Bajra-Napier Hybrid (BNH) is an interspecific hybrid between bajra (*Pennisetum glaucum* L.) and common napier (*Pennisetum purpureum* Schum.) getting more demand in recent days due to high quality herbage yield. The optimum temperature for growth is usually 25–40°C and prefers full sunlight and very much susceptible to frost. This perennial forage grass can be cultivated throughout the year with green fodder yield up to 250 t ha^{-1} yr^{-1} under irrigated and up to 150 t ha^{-1} yr^{-1} under rainfed conditions. The green fodder contains 8.7-10.2% crude protein, 28-30.5% crude fiber, 10-11.5% ash, 42.5-44% ADF and 64-66% NDF on a dry matter basis with high palatability. Under optimum management conditions farmer can take up to 8-10 cuttings annually at an interval of 30-35 days. The annual demand for this grass is gradually increasing from dairy farmers/peri-urban areas, forest departments (development of grasslands and soil & water conservation), NGO's and milk unions. BNH can be cultivated as sole crop and require 40,000 rooted slips per hectare at a spacing of 50 × 50 cm. This can also be cultivated in the existing plantations such as mango, moringa, guava etc., and on the bunds under integrated farming system.

BNH as a sole crop

Variety	Developing institute	Suitable region for cultivation	Potential green fodder yield (t ha^{-1} yr^{-1})
CO-1, 2 & 3	TNAU, Coimbatore	South zone of the country	331-450
Hybrid Napier-3 (Swetika)	IGFRI, Jhansi	North and central zone of the country	165
Yashwant (RBN-9)	MPKV, Rahuri	Irrigated areas of Maharashtra	245
NB-21	PAU, Ludhiana	All India cultivation	180
Phule Jaywant (RBN-13)	MPKV, Rahuri	Maharashtra	225
Sampoorna (DHN- 6)	IGFRI (Dharwad)	Karnataka under irrigated conditions	120-150

BNH with Moringa plantation

BNH on bunds

Canopy Management in Mango

Mango (*Mangifera indica L.*) is one of the oldest and most popular fruits having delightful flavour and taste of the tropical world. Despite India's share of 65 per cent in the world's mango production, it's share in world's fresh mango market is just 5.25 per cent in terms of quantity. However, all the mango importing countries are considering India as a source of quality mangoes due to its varietal wealth and availability. In this background, it is imperative to improve the productivity and quality of Indian mangoes. Canopy management of bearing plants plays an important role in improving productivity and quality of mango.

Ways to improve mango productivity

- Adopting a fitting planting system (High Density Planting or UHDP)
- Micro irrigation and fertigation system
- Better canopy management in mango
- Mechanization in crop cultivation
- Pre- and post-harvest handling like bagging of fruits
- Top working and rejuvenation
- Use of growth regulators on flower induction and setting

Mango tree require pruning

Principles of Canopy Management

Canopy management is the manipulation of tree canopy to optimize the production of quality fruits. It encompasses both training and pruning which affect the quantity of sunlight intercepted by trees, as tree shape determines the exposure of leaf area to incoming radiation. An ideal training strategy aims around the arrangement of plant parts, especially, to develop a better plant architecture that optimizes the utilization of sunlight and promotes productivity.

Light is critical for growth and development of trees and fruits. The green leaves harvest the sunlight to produce carbohydrates and sugars which are translocated to the sites where they are needed *viz.*, buds, flowers and fruits. Better light penetration into the tree canopy improves tree growth, productivity, yield and fruit quality. The density and orientation of planting also impact the light penetration in an orchard. Generally, in close planting, quicker shading becomes a problem. Initial build-up of a strong and balanced framework of the tree is essential for further management. Therefore following points are to be considered during canopy management;

- Maximum utilization of light by regulating the growth
- Avoidance of built – up microclimate congenial for diseases and pest infestation
- Convenience in carrying out the cultural practices
- Maximizing the productivity with quality fruit production
- Economy in obtaining the required canopy architecture
- Formation of strong frame work having branches on all directions at equidistance
- Developing the canopy with centre opened so that it gets better exposure to sun light
- Controlling the structure of the plant to harness the maximum productivity
- Understanding phenological growth to take up operations at right time.

Canopy management in bearing trees:

Mango trees normally respond to pruning by sending out a vegetative flush. Mango trees are terminal bearers, *i.e.,* they flower from the ends of the branches and will only flower on mature wood, *i.e.,* shoots that are six weeks or older. Hence, pruning affects the flowering and yield. It is therefore most important to ensure that the trees do not have enough vegetative flushes with poor yield. It may not be necessary to prune mango trees every year.

The pruning can be done during two phases;

A. First pruning after harvest

First pruning should be done immediately after harvest and completed by the end of June-July. It includes:

i. Skirting: Removal of low hanging branches is known as skirting. It facilitates the operations such as fertilizer application and controlling of weed.

ii. Opening up: Removal of branches inside the tree which cross over or clutter up the centre of the tree restricting the penetration of sprays. One or two uprightly growing branches from center of tree are to be removed to reduce tree height significantly and to increase the availability of light inside the canopy for better photosynthesis. Not more than 25 per cent biomass should be removed at a time; otherwise it results in excessive vegetative growth with reduced flowering shoots.

iii. Hygiene: It involves the removal of any diseased or dead branches in the tree, which could be a source of infection. However, it is need based for trees having yield decline

B. Second pruning – pre flowering

Second pruning may be taken up in the middle of December and, if the timing is right, it is to be followed by a floral flush rather than a vegetative flush.

i. Skirting: Low hanging branches which could cause fruit to drag on the ground are to be removed.

ii. Opening up: Twigs and disorderly branches inside the tree are to be removed to have a open canopy. This not only facilitates spray penetration for better insect and disease control but also allows light into the tree, improving fruit colour.

iii. Tip pruning: It is a useful practice where the trees have had a vegetative flush just prior to flowering. The young flushes are cut back to mature wood; the resulting flush may result into a floral one. Tip pruning will also reduce tree size.

iv. Hygiene: It is essential to reduce the source of flower and fruit infection. Any diseased or dead branches should be removed before flowering.

(Ref- agritech.tnau.ac.in › cm-mango-eng)

Fruit bearing mango tree

Hylocereus undatus- a fact sheet

Hylocereus undatus i.e. dragon fruit is still a new introduction to India and lot of experimentation is underway at institutes and farmer level. Day by day the enquiries about dragon fruit cultivation, production, market, etc. are increasing. In view of this, some facts have been compiled here to get hands on information of *H. undatus* to address various issues related to its cultivation.

Introduction

- Hylocereus undatus (Haw.) Britton & Rose is a climbing vine cactus species of the family Cactaceae.
- It is one of 15 accepted *Hylocereus* species; while many of these have ornamental value because of their flowers, only five are important as fruit producers.
- Common names such as 'dragon fruit', 'pitaya' and 'pitahaya' are generic terms which include several species of columnar and climbing cacti. They are often applied to species other than *H. undatus* too and usually refer to the fruits rather than plant.
- It is native to southern Mexico, the Pacific coast of Guatemala, Costa Rica, and El Salvador. It is now commercially cultivated and widely distributed throughout the tropics and some temperate regions.
- It was introduced to Sri Lanka in 1997, from where supposed to entered in India.
- *Hylocereus undatus* is a fast growing, epiphytic or xerophytic, vine-like cactus.
- Stems are triangular, 3-sided, although sometimes 4- or 5-sided, green, fleshy, jointed, many branched. Each stem segment has 3 flat wavy ribs and corneous margins may be spineless or have 1-3 small spines.
- Stems creeping, sprawling or clambering, up to 10 m long. Aerial roots, which are able to absorb water, are produced on the underside of stems and provide anchorage for stems on vertical surfaces.
- Flowers are 25-30 cm long, 15-17 cm wide, nocturnal, scented and hermaphroditic; however, some cultivars are self-compatible.
- Flowers are typically white in colour and bell shaped, stamens and lobed stigmas are cream coloured.
- Fruit is a fleshy berry, oblong to ovoid, up to 6-12 cm long, 4-9 cm thick, red with large bracteoles, pulp white, edible, embedded with many small black seeds.
- Average fruit weight is 350-400 g, although may weigh up to 900 g.

Dragon fruit orchard

Growth Requirements

- *H. undatus* grows as a climbing cactus in shaded or semi-shaded positions under large canopies, it may be injured by extreme sunlight and can tolerate some shade; however, it is considered to be a full sunlight crop in Central and South American countries.
- When growing naturally, it attaches branched stems to trees or rocks via adventitious roots. Under cultivation the vine-like stems are supported by a post and trellis system.
- Optimum temperatures for growth are 18-25°C, with good relative humidity levels.
- Dragon fruit, while being a type of cactus, perform poorly under extremes of temperature and cannot tolerate high light and temperature.
- *H. undatus* is tolerant of windy conditions and moderately saline soils.
- Like many cacti, it has a low water demand, which is related to its crassulacean acid metabolism (CAM) mode of photosynthesis - uptake of CO2 occurs during the night when the stomata are open, which restricts water loss via transpiration during the heat of the day. Due to this during hot summer there is no cooling effect that results in to sunburn damage to the leaves.
- In high radiation areas, overhead shading is often installed, which also helps reduce extremely high temperatures which can limit flowering and fruit set.

Horticultural Aspects

- *Hylocereus undatus* is a perennial long-lived plant. In cultivation it starts fruit production from the second year onward.
- It is a day length sensitive plant and flowering is induced by longer days. In India flowering occurs from June to October while in Sri Lanka it flowers from April to November.
- It has hermaphroditic flowers. They open at night and nocturnal visitors include the nectar-feeding bats and the moths are main pollinators of this species.
- Sometimes the flowers remain open the next morning and are also visited and pollinated by bees.
- It has a mixed breeding system in which selfing and outcrossing set fruits. Hand pollination is also used with self-incompatible varieties to ensure good fruit set and fruit size.
- Many new commercial operations are utilising new cultivars which are self-fertile to avoid the cost of hand pollination. Many of the varieties bred in Asia are now self-compatible and will set fruit relatively easily without requiring hand pollination.
- The main disadvantage with many of the self-compatible varieties of dragon fruit is that the fruit is often smaller than if the flowers were cross-pollinated with pollen from a different clone or different species. This may be due to fruit weight, which is positively correlated with the number of viable seeds and dependent on pollination.
- Hand pollination is carried out by removing the anthers from one flower and brushing them against the stigma of another flowers.
- Commercial growers have to determine if it is worthwhile hand pollinating flowers in order to obtain a greater fruit weight, given the cost on increased labour on the background of larger fruits.
- Often the first wave of flowers will not set fruit in self-incompatible varieties that can be tackled by hand pollination.
- Pollen collected from dragon fruit flowers can be stored after drying to a moisture content of 5-10% and below-freezing temperatures for 9 months to pollinate the first blooms of the season, resulting in an earlier and larger crop.
- Commercial dragon fruit growers in Taiwan use supplemental night break lighting to increase the flowering period after the normal period of flowering has finished. Flowering is induced by breaking the dark period with lighting between 22:00 and 02:00 hr. These Fruits produced in the off-season often receive premium prices as they are larger and sweeter than those produced from summer crops.

Pest and Diseases

- In many dragon fruit cultivation regions, fruit flies are a major pest affecting fruit quality. Oriental fruit fly (*Bactrocera dorsalis*) and guava fruit fly (*B. correcta*) are species that both lay eggs in fruits and the larvae can develop successfully even when the fruits are too green to eat.
- Aphids may infest flowers or fruits in some regions and young plants can be vulnerable to slugs and snails under damp conditions.
- Rabbits, squirrels, possums and similar pests have been known to feed on the lower stems and mice, rats and birds will eat ripe fruits.
- In Madhya Pradesh, Rajasthan and Gujarat, it is reported that monkeys are big nuisance as it feeds on leaves.
- Diseases like stem rot caused by *Xanthomonas campestris* and brown spots on fruits caused by *Dothiorella* in some production areas.
- Viruses such as Cactus virus X (CVX) have been reported on dragon fruit plants, causing symptoms such as stunted, malformed and mottled growth. In Taiwan, CVX is widespread in dragon fruit orchards, with infection rates of 60-90%.
- A strain of *Fusicoccum* has been isolated from stems of *H. undatus* and is also a host to quarantine significant rust.

Dragon fruit at flowering stage

Canopy & *Bahar* Management in Pomegranate

Canopy of a tree refers to its physical composition comprising the stem, branches, twigs and leaves. But the canopy density is determined by the number and size of leaves which is measured as LAI (Leaf Area Index). Moreover, canopy architecture has significant impact on fruit production which is determined by the number, length and orientation of branches and shoots. In any fruit crop, for optimum fruiting and quality fruit production, the canopy management of the tree is prerequisite that deals with the development and maintenance of their structure in relation to the size and shape.

- The basic idea of canopy management is to manipulate the tree vigour and use maximum available light and temperature to increase productivity, fruit quality and also to minimize the adverse effects of the weather.
- Pomegranate is a light loving plant thus enough light should be available in the tree canopy for quality fruit production. The green leaves trap the sunlight to produce carbohydrates which are then transported to the sites (buds, flowers, fruit etc.).
- Restricting the build-up of micro-climate congenial for the development of diseases and insect pests and convenience in carrying out the cultural operations are also important considerations in canopy management.
- Balance between vegetative and reproductive growth must be maintained giving emphasis to have less wood and more fruit on plant canopy.

1. Tree growth and structure: Pomegranate is a shrub or small tree that tends to develop multiple trunks and has a bushy appearance. Depending upon variety and agro-climatic conditions, it can grow up to 5 m. Most of the varieties are deciduous and in Deccan Plateau, the trees are evergreen or partially deciduous. The density and orientation of plants have impact on light penetration in the orchard. The closer the planting, the poorer will be light penetration. Strong bearing branches tend to produce larger fruits and they also transport water and nutrients more efficiently throughout the tree. Thus, pruning should aim to encourage new strong growth.

2. Training system:

Multi-stem training system: In multi-stem training system, 3-4 strong stems with 6-8 strong fruiting branches (thick ones) are allowed to produce good quality fruits from fourth year. Multi-stem training system has some disadvantages that it complicates many cultivation practices such as pruning, spraying, removal of unwanted growth (suckers) and fruit harvesting.

Single stem training system: Recently, single stem training system in pomegranate has already been started in some countries like the USA and Israel because of its many advantages over multi-stem training system. It has been reported earlier that pomegranate is highly susceptible to stem borer and shot hole borer so not much emphasis was given on this training system in India.

Single trunk up to 30 cm (stem) with 3-4 main branches (limbs) in vase shape training up to 3.5-4 m is a common practice in modern orchards. Properly irrigated and fertigated orchards trained in this way often produce >30 tonnes fruit/ha. Undoubtedly, there seems to be scope for promotion of single stem training system in India as the canopy architecture in this system develops very well which is suitable for higher productivity and easy farm operations.

Pomegranate plan after bahar initiation

3. Maintenance pruning of bearing trees: A more regular programme of pruning starts from third year onwards with the following basic objectives:

- To remove dead, diseased, broken and weak or old branches
- To remove crossed over branches or branches in the wrong place.
- To reduce tree height and width
- To open up the tree canopy to improve light and air penetration
- To remove unwanted re-growth or strong suckers or suckers arising from the ground level
- To manipulate tree form, shapes and growth
- To manipulate flowering, fruit set and crop load
- To rejuvenate old trees
- To improve spray coverage
- Rejuvenation pruning is generally carried out in old or bacterial blight infected trees to improve their cropping potential.

Bahar Management

Pomegranate flowers continuously when watered regularly. The plants under such conditions may continue bearing flowers and bear small crop irregularly at different period of the year, which is not desirable for commercial production. To avoid this, trees are given *bahar* treatment by withholding irrigation 1-2 months prior to the bahar, leading to the defoliation. The trees are then medium pruned, recommended doses of fertilizers are applied immediately and irrigation is resumed. This results in to profuse flowering and fruiting. The fruits are ready for harvest 4-5 months after flowering. In tropical condition, there are three flowering seasons, viz., January-February (ambia bahar) June-July (mrig bahar) and September-October (hasta bahar). The choice of flowering/fruiting is regulated taking into consideration the availability of irrigation water, market demand and pest/disease incidence in a given locality.

- The fruits of ambia bahar are ready for harvest in the month of June to September. As the fruit development takes place during dry months, they develop an attractive colour and quality thus suitable for exports. Similarly due to dry weather, the incidences of pest and disease attack are limited. However, ambia bahar can be taken only areas having assured irrigation facilities.

- The mrig bahar crop is harvested in the month of December to February. Usually this bahar is favoured as the flowering and fruiting period coincides with rainy season or immediately after rains, and the crop is taken without much irrigation. As the fruits develop during the rainy season and mature during winter, the colour and sweetness of the fruit is affected.

- The fruits from hasta bahar are harvested during the month of March to April. They have very attractive rind with dark coloured arils. Since the availability of the fruits during this season is limited, they fetch high value. Optimum water stress cannot be developed during this period as withholding of irrigation coincides with the rainy season. This leads to poor flowering and thus affects the yield.

Flowering in pomegranate

Pomegranate fruit growth

Machinery and Equipment at NIASM Farm

ICAR-NIASM farm is very well equipped with various type of machinery and implements at service. These includes the tractors of various sizes, power tillers, trailers, water tanker, various tillage and specialized implements. Description and functions of these implements is as follows;

Tillage equipments:

Moldboard plough: A moldboard plough cuts, lifts and turns the soil and in doing so buries the crop residue, aerates the soil, controls weeds, insects and soil borne diseases, incorporates fertilizer into soil, provides good seedbeds and breaks hard pan. The plough should be used only on land where topsoil is sufficiently deep to avoid mixing of the subsoil with the surface soil.

Disc plough: It is used for primary tillage mostly on hard and stony soils where deep ploughing is not desirable. It consists of concave disks mounted on frames. Its working depth is controlled by one or more wheels or hydraulic systems.

Sub-soiler: Sub-soiling is done to break up impervious soil layers below the normal soil tillage depth to improve water infiltration, drainage and root penetration.

Cultivator: It's both primary and secondary tillage implement and very widely used in open fields and orchards. Heavy duty harrows are used for primary tillage and light to medium harrows for secondary tillage, seedbed preparation, summer fallowing, chemical incorporation, weed control, to cover broadcast seed or fertilizer, etc.

Offset disc harrow: It is used to pulverize soil and break clods by cutting and throwing action, cut the chaff and trash, destroy weeds, provide primary tillage when ploughing is difficult and demolish ridges to provide an even surface. The disk's construction varies to meet specific requirement.

Rotavator: It brings top soil layer to fine tilth by breaking small clods with moving blades. It should be used carefully because it works on top 6-9 cm layer only while lower layer gets compacted due to sub-soil moisture.

Ridger: A ridger equipment available is used to prepare single ridge and two furrows in one pass. The width and distance between two ridges can be adjusted from 3' to 6' by moving it on frame. Ridge and furrow layout facilitates furrow irrigation, prevents erosion of top soil, helps in water conservation in soil profile, provides better drainage and prevents water logging, provides un-compacted soil for root growth and partly reducing of fertilizers.

Mechanical seed drill: Sowing by machine is advantageous as it is quick, accurate and uniform. Machine sowing results in to uniform germination as the furrows are opened and closed immediately the seed is placed accurately and the soil can be evenly packed around the seed. There different type of discs available to facilitate sowing of different type of seeds with single machine at different spacing.

Leveler: It is used for moving soil from one place to fill depressions so as to level the field. The equipment can be used in both directions by changing attachment positions.

Earthing-up blade: Earthing up is required in some orchards wherein this equipment moves soil in between rows towards plant rows. Thus it creates a raised bed throughout the row length. It can be used various row width by adjusting the length and angle of equipment on by attaching additional fin if required for wider plantations.

Ploughing operation

Seed drill at sowing

Specialized implements

SORF machine: This machine has been developed at ICAR-NIASM under 'Conservation Agriculture' project, for sugarcane ratoon management. It performs multiple operations in harvested sugarcane field for better ratoon crop by retaining trash. At first the moving disc cuts the sugarcane stubbles at uniform height at soil surface, while root pruning is carried out simultaneously for healthy sprouts and better root development. A small trench parallel to row is opened and closed immediately after fertilizer and/ or seed deposition through mechanical drill. It allows intercrop in ratoon sugarcane. All these activities ensures healthy growth of ratoon crop with extra benefit from trash maintained in field. This machine is helpful in promoting farmers to retain trash in field and eliminate pollution threat due to trash burning.

Mulcher: This is a heavy duty tractor mounted equipment used to run in field after harvesting to cut the plant remains into fine pieces. It has number of cutting bladed on moving as well as stationary shaft to fine cut the agro-waste. It can cut medium thick branches, trash and shrubs. The cut material is then incorporated to soil by ploughing for natural decomposition. It can be used in orchards to use pruned mass as organic mulch.

Shredder: This is a heavy duty trailed type equipment operated through PTO of a tractor. The agro-waste like coconut leaves, medium sized green branches and weed shrubs are put in to shredder for chaff them in small pieces. The shredded material is used for composting or in vermicomposting beds for recycling.

Thresher: Institute is having trailed type, tractor PTO operated, multi-grain thresher for general threshing purpose. It can be easily moved to the field threshing is required. By changing the sieves and stud size it can be used for threshing of various grains. Maize can be threshed without shelling of cobs.

Post-hole digger/ augur: This is PTO operated screw type augur used to drill different sized pits for post installation or tree planting. It works well in soft soil without stones.

Happy seeder: There is tractor-mounted machine that cuts and lifts straw of previous crop, sows wheat into the soil, and deposits the straw over the sown area as mulch. It reduces residue burning that has enormous impacts on human health, soil health, the economy and climate change.

Trailed type sprayer: This is 400L tank capacity sprayer with diaphragm pump to create pressure. The spraying can done with manual booms or with blower. It works on tractor PTO and helps to spray in orchards as well as field crops by standing outside the field or by passing through the rows.

Mounted blower: This sprayer has tractor mounted 200L spray tank created enormous pressure with the help of PTO operated diaphragm pump. The spray solution is passed through the fixed nozzles that can be adjusted to reach the canopy of small trees. It is equipped with high speed blower which further creates air blow to through small water particles inside the canopy. The air blow helps to shake the leaves to get covered by spray from both sides.

Self-propelled implements

Power tillers: The 13.5 hp VST make power tillers are used for precision type works in orchards to pulverize soil, cultivation practices in small fields and sugarcane earthing-up. The small trolley attached to it helps to manage material shifting.

Reaper: Used to harvest crops like wheat and maize. It cuts the crop and throws in line to one side.

Brush cutter: It is petrol engine operated portable cutter for making area weed free or used to harvest some field crops.

Lawn mower: It is electrically operated lawn mower used for timely cutting of lawns.

Hedge cutter: This is petrol engine operated and electrically operated machine used to give shape to the hedges and edges.

Trailed type sprayer

Targets Ahead

Water budgeting: After development of water storage facility at campus still there is scope to improve it. Height of the 'Manas pond' can be raised to increase storing capacity. Simultaneously, it is necessary to work on judicious and efficient use of water through water budgeting. The water requirement of each crop will be calculated and measured quantity only will be supplied through 'Automated Irrigation and Fertigation Facility'. Plan is to install water meters on each line to keep better track of water utilization not only for irrigation but also by other utilities.

Micro-irrigation expansion: For better utilization of water, all the fields need to be brought under micro-irrigation system at the earliest. Further, all these will be managed through Automated Irrigation Facility.

Naxatra Udyan: The plantation of shrubs have been carried out. Now maintenance of all the shrubs and trees is a necessary. The walking paths are to be developed inside along with sitting arrangements in the centre. At any given time the 'Naxatra Udyan' should be in presentable form. All the information related to plants to be made available to visitors on boards and also through digital way.

QR NIASM: Some field projects have been brought under this app through QR codes. All projects, plants and facilities will have QR code in future to provide information in brief in audio format.

Actions to Facilitate Agri-Tourism: The Agri-tourism concept have been launched already. The visitors like to visit farm and it will be kept ready for these visits. Beside the regular cultivation and cleaning practices a fine tuning is required keeping in view the interests of the visitors.

Malad Farm Developments: About 15 fields have been made ready for field experimentation. Irrigation water facility have to be developed at the earliest. A Farm pond of about 12 million litter capacity will be developed. Two bore-wells have been planned. Solar pumping systems will be installed for irrigation purpose. The fields have to be made ready for serious experimentation from *Kharif* 2022 season.

Challenges in Dragon fruit production

Dragon fruit plant (*Hylocereus undatus*) has low water requirements and adapts to different soil types. It requires long days to flower and in Maharashtra the blooming coincides with the beginning of rainy season in June and lasts until October; during this time six to eight overlapping flowering cycles happen. Now the fruiting season has been already started and following seasonal issues have to be taken care of;

- The fruit thinning has to be carried out immediately after fruit set; leaving only one fruit per shoot for better quality.
- As experienced for last 4-5 years, management of fruit fly in dragon fruit orchard is very big issue.
- As an IPM practice, clean cultivation is important.
- Spraying of biological control agents *Metarhizium* and *Beauveria* to be used in early phase. The prevailing rainy weather will help in its establishment

Dragon fruit plan growth

- Install pheromone traps in orchard to trap fruit fly males.
- Spraying of neem based insecticide will also help in management of the pest.
- Being a soft skinned and attractive fruit, the bird damage is also more prevalent. Use of bird net or bagging of fruits will help to reduce this damage.
- Controlled watering is must or otherwise there will be fruit cracking.
- Harvesting of fruits to be carried out at perfect maturity.

Water Treatment & Reuse

Orchard Planting Techniques

Agroforestry Project

Sanjivani Garden

Biodiversity Project

NASF Project

Chickpea Germplasm

Farming Syatem

Malad Farm

Livestock Unit

Dr. Santanu Kumar Bal
Project Coordinator, AICRP on Agrometeorology
ICAR-CRIDA, Hyderabad

NIASM's Farm Development model has been unique of its kind, and I am glad that I had been a part of it as OIC Farm. We had started keeping records of targets and achievements during the progress of the farm development which helped the farm management team in many ways. Now I am happy to see that the farm related achievements are being documented in a monthly newsletter 'Farm Coordinator'. My best wishes for the release of special issue of the newsletter. I also wish to see research and developmental activities at NIASM's model research farm at new heights.

Dr. Ratna Kumar Pasala
Principal Scientist, ICAR-IIOR, Hyderabad

Greetings! and congratulations on your special issue of 'Farm Coordinator'. It is quite impressive and interesting to know about the development that took place at NIASM Farm during the past 5 to 6 years.

Go for intercropping with short duration pulses like horse gram in orchards, to enhance soil health.

Apply foliar sprays of some coolant bio-regulators or radiation reflections chemicals for the amelioration of sunburn in Grape and Mango plants.

Go for foliar application of salicylic acid sprays for reducing flower drop and to enhance fruit set in Mango.

Mr B. K. Sinha
CAO, ICAR-CIFA, Bhubaneshwar

NIASM 'Farm Coordinator' is a glimpse of research activities undertaken from the perspective of farm management. The publication also provides vital meteorological data, soil condition, irrigation and other inputs required for multi-disciplinary research on month to month basis. I have keenly followed the journey of 'Farm Coordinator' during the last twenty four months. It has evolved into an informative and a well-crafted publication. Readers find it interesting. In the months ahead, I would like to see a guest-column. An expert may be invited for a 250 word write-up on a relevant topic.

I take this opportunity to thank the Director, to you and your team. May this publication attain greater heights in terms of content, readership and critical appreciation in the months ahead! Wishing Farm Coordinator all success.

Dr. Sushil Kumar
CTO, ICAR-CPRI, Shimla

Heartiest congratulations for your new publication. You are dealing with many crops therefore in my opinion it may be more attractive if can you mention economics of at least one crop in each issue so that farmer could select better crop for his field.

Mr. Uttam N. Borse
ACTO, ICAR-NRCG, Pune

Congratulation the team for taking initiatives for shaping up 'Farm Coordinator' concept. This will definitely be helpful to bridge the gap between the farm management team members working at different location in the field. Such initiatives are necessary for better output from research farms.

प्रगति के पथ पर

अनुसंधान प्रक्षेत्र प्रबंधन, कला और वैज्ञानिक प्रक्रिया का हिस्सा है। कर्मचारियों के बीच बेहतर समन्वय और उपलब्ध संसाधनों का, जैसे श्रमशक्ति, मशीनरी और सामग्री के रूप में विवेकपूर्ण उपयोग एक पूर्वापेक्षा होती है। इस समन्वय को बढ़ाने के लिए फरवरी 2020 से 'प्रक्षेत्र समन्वयक' की शुरुआत की गई थी। इसके पीछे मूल विचार हर महीने लक्ष्य और उपलब्धियों का दस्तावेजीकरण करना, मौसम का सारांश देना और खेत/फल फसलों, बुवाई/रोपण, कनोपी प्रबंधन, सिंचाई, पोषण, खरपतवार प्रबंधन और पौध संरक्षण से संबंधित आवश्यक तकनीकी जानकारी का संकलन करना था। प्रलेखन भाग अधिक समय लेने वाला नहीं था, बल्कि यह अंतिम परिणामों को देखते हुए तकनीकी कर्मचारियों के बीच रुचि पैदा करता है।

पिछले दो वर्षों की बात करें तो यह देखा जा सकता है कि न केवल प्रकाशन की सामग्री की गुणवत्ता बल्कि समग्र कृषि प्रबंधन गतिविधियों की भी गुणवत्ता में सुधार हुआ है। अनुसंधान प्रक्षेत्र प्रबंधन की प्रक्रिया में लक्ष्यों और उपलब्धियों के दस्तावेजीकरण में शामिल तकनीकी कर्मियों में पारदर्शकता, रुचि और उत्साह में वृद्धि हुई। आवश्यक तकनीकी जानकारी पर केंद्रित कार्यों के माध्यम से कोई क्रिया आंख मूंदकर नहीं कराई जाती है। महत्वपूर्ण उपलब्धियों में से, लिफ्ट सिंचाई प्रणाली के माध्यम से सिंचाई सुविधा का विकास और 'मल्हार' तालाब के रूप में जल भंडारण सुविधा, बुनियादी जरूरत को पूरा करने के लिए बहुत आवश्यक थी। इसके अलावा, हर फसल के लिए विवेकपूर्ण जल बजट और स्वचालित सिंचाई एवं फर्टिगेशन प्रणाली के माध्यम से इसके कार्यान्वयन पर अधिक ध्यान देने की आवश्यकता है।

फीडबैक और सुझावों के अनुसार, 'प्रक्षेत्र समन्वयक' में विभिन्न संस्थानों के फसल विशेषज्ञों से खेत की फसलों की सांस्कृतिक प्रथाओं के साथ-साथ बगीचों के रखरखाव की जानकारी संकलित करके कुशल श्रमशक्ति विकसित करने की आवश्यकता है। प्रगति की योजना के अनुसार अनुसंधान फार्म में इन सभी गतिविधियों को व्यावहारिक रूप से प्रदर्शित करना होगा। मशीनीकरण को बढ़ावा देते हुए कार्य दिशा-निर्देशों के अनुसार प्राकृतिक खेती की ओर बढ़ने की योजना तैयार करनी है।

Plan For Progress

Research farm management is the art and science proceeding hand in hand. Better coordination amongst the staff and judicious use of available resources in the form of manpower, machinery and material is a prerequisite. To increase this coordination the 'Farm Coordinator' was initiated from February 2020. The basic idea behind this was to document the target and achievements every month, giving weather summary and compiling the necessary technical information related to field/ fruit crops, sowing/ planting, canopy management, irrigation, nutrition, weed management and plant protection. The documentation part was not much time consuming, rather it creates interest among the technical staff due to ultimate results.

Looking back to the last two years, it can be noticed that the quality not only of content of the publication but also of overall farm management activities has been improved. Documentation of targets and achievements in the process of research farm management increased the transference, interest and enthusiasm of technical personnel involved. The technical basics page focused on each and every action through required know-how and works are not being done blindly. Out of the significant achievements, development of irrigation facility through lift irrigation system and the water storage facility in the form of 'Malhar' pond, were very much required for fulfilling the basic need. Further it is required to go for judicious water budgeting and its implementation through automation.

As per the feedbacks and suggestions, it need to develop skilled manpower by compiling information about cultural practices of field crops as well as in orchards from various experts from specific institutes. The plan for progress is to demonstrate practically all these activities in research farm. The task is to increase mechanization still progressing towards natural farming as per the guidelines.