

From Director's Desk

Being located at a water scarce area, irrigation water supply to the farm of ICAR-NIASM has always been a major challenge. The problem is aggravated by poor water holding capacity of the soil, poor quality of water and incidences of biotic stresses such as polyphagous 'fruit fly'. We are in short of storage facility to fulfill the requirements during the closure of the nearby canal. The shortage of water during peak stages adversely affects the current as well as the next crops, especially orchards. The Institute is working in a mission mode with coordinated scientific approach, technical expertise & administrative support to resolve the issues.

Major activities in the NIASM Farm during February-March, 2020 included harvesting and threshing of wheat & chickpea; harvesting & trash management in sugarcane; training & pruning in fig, managing *bahar* initiation in pomegranate, harvesting of grape & flowering management in custard apple. The Newsletter, now in its second issue, provides detailed information regarding the farm activities during the last month and plan of work for the coming month.

I sincerely hope that the Newsletter will help the scientists and farm personnel to improve their coordination. I congratulate Dr. Pravin Bhimdeo Taware, Senior Technical Officer (Farm) & Farm Manager and the contributors for bringing out this useful publication.



Himanshu

(Himanshu Pathak)

March 21, 2020



Plan For Progress

The '*Vasant*', being a king of *rutus* as per Indian tradition, brings a new ray of hope for farmers through crop production. At NIASM we have already harvested wheat and chickpea of *rabi* from general fields. In orchards grapes are being harvested along with some sweet orange fruits. Early *Mrig bahar* is initiated in pomegranate to avoid the damage due to oily spot disease during regular *bahar* and non-flowering in *Hasta bahar* due to return monsoon showers. Flowering in anola, mango, karonda and custard apple being good we expect good fruit set too. However, there was 10 days canal closure during March 2020 that may lead to draught stress and consequent poor fruit set/ drop. Efforts were made to procure water from outside to fulfill part requirements at sensitive stages. Considering the floral biology of the custard apple, water sprays are being executed to alter microclimate for increasing pollen vitality, effective pollination and fertilization. Efforts will be made to carry out artificial pollination to achieve better fruit set.

The proposal for enhanced water storage at southern side of the field is in pipeline which is a pre-requisite for commissioning of the new lift irrigation project. If it works out we are hopeful to tackle the situation of water shortage during canal closure period. Considering need to improve water holding capacity of soil & organic carbon content, the proposal submitted for procurement of FYM is in process. Hopefully, when both the works are completed during next month it will improve experimental orchards.

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Wheat harvesting and threshing: Rabi wheat from general fields D-5,6 (var. HD 2189) and E-5 (var. LOK-1) was ready for harvesting in first week of March 2020. The harvesting in D-5,6 was carried out manually by employing workers because this field is very stony. While the harvesting in E-5 was carried out with the help of reaper. Use of reaper found to be very effective regarding quality and efficiency of work. Threshing of wheat from both fields was carried on March 11, 2020.



Chickpea harvesting & threshing: Chickpea (Var- Digvijay) from B-8 and E-7-8 was harvested selectively during last week of February 2020, looking into the maturity of the crop. Harvesting was carried out manually in morning session only to avoid losses during handling. Threshing work was carried out by using institute's multi-crop thresher. Although chickpea was grown in native soil, the produce was of good quality with bold grains.



Sugarcane harvest & trash management: Harvesting of sugarcane was pursued with Malegaon Sugar Factory and it was executed by them from 21st February 2020. Harvesting from the fields A1, A2, B1, B3, C2 and C9 was going on till first week of March. After harvest the trash cutting was carried out with the help of tractor drawn mulcher machine. This machine shredded most of the trash in to small pieces making the fields ready for further preparatory tillage operations.



Experimental field crop sowing: Layout in the form of 90 cm wide ridges and furrows was prepared in field D-4 for experimental sowing of summer mungbean. Mungbean (var. GAM-5) was sown by dibbling method on both sides of ridges. It was followed by irrigation next day. To rectify the poor germination in groundnut (C-6) gap filling was also carried out. Layout preparation in cropping system field was carried out to make it ready for sowing as per the treatment requirements.



General campus cleaning: As regular irrigation was facilitated in experimental as well as general *rabi* crops, there was profuse weed growth in the fields, bund and channels. The weed removal was carried out through manual weeding operations. All the roadsides including farm roads, peripheral road, concrete roads and their foot paths were looked after for making weed free especially parthenium and plastic free. The debris at dump site were arranged properly.



Irrigation related activities: The irrigation activities mainly dependent on canal status and electrical load shading. Efforts are made to irrigate south farm fields during diesel engine operation i.e. from Monday to Thursday. And on remaining days water used to be stored in water balancing tank for use in orchards and landscape garden. There was a canal closure for ten days during March 20. The urgent needs for utility and life saving irrigation achieved by procuring water from outside.

Training and pruning in Fig: The fig plants need to be trained and pruned for desired canopy and better fruit yield. The number of main stems were limited to three by removing extra sucker growth and stems were cleared up to height of 60-cm. The branches obstructing the movement in between and criss-cross branches were pruned for ease in operations. All the damaged fruits were removed and disposed of as a part of clean cultivation to avoid disease in future.



Pomegranate bahar initiation: As a *bahar* treatment pomegranate orchards were left with stress by withholding irrigation. On sufficient defoliation the irrigation was started from March 1, 2020 to initiate the *bahar*. Spraying of insecticide and fungicide was carried out to reduce the inoculum load. To ensure desired supply of water through drip irrigation system, the drippers were checked for discharge and rectified the blockages if any. Pruning of unwanted branches was started.



Harvesting of Grape: Sharad seedless grapes were ready for harvest from mid-February and Thomson seedless from March 2020. The harvesting was carried out to sale on the same day at campus & excess material was sent to APMC Baramati. During this production year the grape suffered natural calamities like heavy rains after forward pruning that lead to more incidence of downy mildew disease. The crop suffered severe water stress during fruit bud development.



Custard apple flowering management: As discussed in floral biology of custard apple there is profuse flowering in custard apple from March onwards. However, due to high temperature and less humidity during this period there is very little or no fruit set. Therefore, efforts were made to improve the fruit set by altering micro-climate through water sprays and use of plant cover. The plant basins were pulverized and normal irrigation was started to promote flowering.



Plant Protection Measures:

- Prophylactic spraying of Profenophos 1.5 ml/L followed by Copper oxy chloride 2.0 g/L was carried out in Pomegranate before starting irrigation to initiate *bahar*.
- Spraying of Myclobutanil 0.5 g/L and 0-52-34 @ 2.0 g/L was carried out in Thomson seedless grape in last week of February to check powdery mildew spread.
- Spraying of Wetttable sulphur @ 2.0 g/L and Azadiractin 1% @ 1.25 ml/L was carried out in Mango orchard during February last week to check powdery mildew and hopper pest. During March infestation of aphids was observed with sticky exudates on leaves. Therefore, in mid March spraying of Fipronil @ 0.8 ml/L and Carbendezim 1.0 g/L.
- Spraying of multi-micronutrient mixture @ 2.0 ml/L to fix deficiencies was done in citrus orchards.
- Fertilizer application through drip i.e. fertigation with 0-0-50, 12-61-0 & Urea was carried out twice in citrus fruits, grape and sapota.



• **Water Storage tank:** In an ongoing new lift irrigation scheme the water pumped from canal is going to be poured in a southern side 'Water Storage Pond' from where it will be lifted again for irrigation and filling 'water balancing tank' at north block. The lift irrigation work is known to be at completion and for its testing and commissioning, this intermediate water storage pond is must. However, this structure is neither exists presently nor it is a part of ongoing scheme. Therefore, it is proposed herewith to undertake the activity of preparation of 'Water Storage Pond' in a part of the designated area. The initial proposal was meant for hiring of machinery to excavate and bund preparation. After this black soil will be procured for cushioning for plastic lining on the bottom and sides. The pond will be lined with 500micron thick HDPE sheet to avoid seepage of water. This work is to be taken up on mission mode so as make the lift irrigation scheme fruitful and to commission in scheduled time to resolve the scarcity of water in farm.

• **Fallow cultivation:** After harvest of *rabi* crops, the field preparation will be started by fallow cultivation. The tillage operations will be carried out sequentially starting with ploughing followed by rotavating and cultivator operations. Parthenium grass in the open field will be roughed out before going for cultivation so as to decrease the seed load. Some of the fields require leveling due to accumulation of soil at one or another end. The levelling of these fields will be taken up to ease the flood irrigation. This will be carried out with the help of institute tractor & leveller equipment.

• **Sowing of Green manure crop :** With the availability of irrigation water some of the fields will be sown with Dhaincha as a green manure crop to improve organic carbon content of soil and to increase water holding capacity consequently. Especially native soil fields have very coarse texture and require more frequent irrigation, therefore efforts will be made to improve its' water holding capacity. After desired growth dhaincha will be ploughed down at flowering stage.



• **Cropping system layout:** There was a cropping system experiment in field B-5,6 in south farm, although completed it is to be re-established by making the layout as per the designated treatments. Due to dense weed growth seasonal crops were removed and field was cultivated thoroughly. The field will be made ready for new planting/ sowing during up-coming *kharif*. The perennial plantations like Leuceuna, Napier and other grasses will be maintained as it is with required gap filling to be done.



• **Weed management and disposal of agro-waste:** Weeds in the experimental fields, along road sides and bunds will be roughed out manually by weeding operation. The open fields after harvesting will be made parthenium free first before going for tillage operations. The debris collected from various fields will be sorted for its use as a fodder, bedding material for animals and supplied to animal unit. The decomposable portion will be handed over to compost unit and the thorny as well as diseased one will be destroyed by burning.



- Installation of rain pipe irrigation system in native soil field to access the water use efficiency
- Spraying in general maize for management of army worm
- Harvesting and threshing of general and experimental *rabi* crops like wheat, chickpea, quinoa, etc.
- Repairing of damaged plastic lining of water balancing tank is to be done to fix leakage problems.
- Procurement of fertilizers and agrochemicals for regular maintenance of crops

• **Back pruning in grape:** Production cycle of grape in tropics includes two types of pruning viz; Back pruning and Forward pruning. Back pruning in grape is generally carried out in the month of April. It is very important operation from the point of initiation of next production cycle. Therefore it is rightly termed as foundation pruning too. Harvesting in Sharad seedless is already over while in Thomson seedless it is still going on. Therefore the back pruning in grape (G-4 & J-5) will be started from first week of April 2020 and ended by third week. The pruning work includes cutting the one year old canes by leaving single basal bud, maintaining the basic frame work of the vine. Spraying of copper fungicide and contact insecticide will be done to eradicate the inoculum and remains if any on the stem and cordons. It will take about 15-days for sprouting after back pruning and development of new shoots. A small trial on water sprays will be conducted to enhance sprouting under hot and dry weather conditions. The stages after this pruning are very also crucial and time bound i.e. shoot growth, fruit bud differentiation, development of bunch primordia and food storage in grapevine. During this period base for new crop is prepared inside the grapevine.

• **FYM application in orchards:** The orchards are grown on very coarse textured murum type of soils having very poor water holding capacity. In spite of frequent irrigation through drip system the intermittent severe stress due to shortage of water during canal closure hampers the normal growth and production of the plants. Therefore, a proposal for procurement of manure (FYM) have been raised for application in orchards. Hopefully, FYM will be procured in April 2020 and application will be started immediately around the plants in basins @ 5-10Kg per plant depending on canopy size and spacing. The soil will be pulverized thoroughly to mix the manure and cover it with soil in the basins. This is going to help in increasing organic carbon content of soil and thereby increasing water holding capacity.

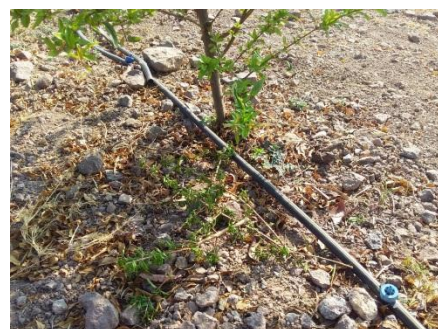
• **Dragon fruit plant training:** Presently it's a non-fruiting stage in dragon fruit. However, the shoot growth goes on vigorously. The drooping branches touching to ground and extra growth making the canopy dense are required to be pruned as a regular practice. Shoots exhibit the symptoms of sunburn showing watery lesions have to be pruned out to avoid secondary infection. The dragon fruit plants in H-5 terrace are to be trained on concrete poles. The earthing up is required to close the open root system and to support the new growth.



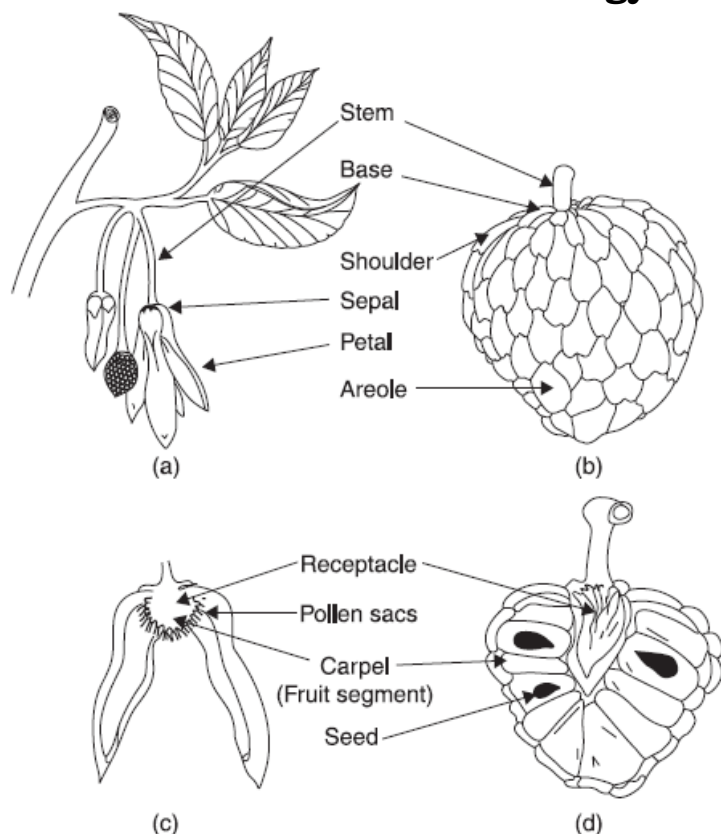
• **Plant protection:** With increase in temperature pests like thrips, aphids will be a problem on young growing shoots of in the orchards especially pomegranate, grape and sweet orange. Neem based insecticide will be used as a control measure. In mango spraying of micronutrients like zinc and boron will be required to avoid deficiency symptoms. Pasting with lime solution with insecticide will help to overcome problem of shoot borer in aonla. To avoid secondary infections in after sunburn in dragon fruit broad spectrum fungicide will be sprayed.



• **Drip irrigation system maintenance:** Drip irrigation systems were laid in orchards at the time of planting. Over the time drippers get clogged due to silt and algae leading to poor discharge of water. Therefore, the drippers and laterals will be cleaned by Hydrochloric acid treatment and manually by removing silt and flushing. Permanently damaged drippers and other accessories will be changed and all the leakages will be rectified. This will ensure uniform water discharge to the plants as per the requirements.



Floral Biology of Custard Apple



Structure of leaf, flower (a) & fruit (b) of custard apple, floral and fruit structures (c-d) showing multiple ovaries on a single flower

- Flowering in custard apple & other annona species appears in different flushes although March & August were observed to be major bloom periods under tropical central region of India.
- Flowers were terminal or axillary and borne solitary, paired or in multi-flowered fascicles either on new or older branches or on the main trunk as cauliflorous nature of bearing.
- The flowers are hermaphrodite and dichogamous in nature.
- The anthesis takes place at morning 5:30 am to 6:30 am and anther dehiscence at 12 pm to 2 pm of next day of the anthesis and stigma receptivity start a day prior to anthesis and continue up to day after anthesis but found maximum receptivity at the day of anthesis.
- In cherimoya the anthesis takes place at 7 am to 9 am in the morning, anther dehiscence at 12 pm to 4 pm of next day of the anthesis and maximum receptivity found at the day of anthesis.
- Atemoya flowers are borne on current season growth.

Pollination:

- The flowers are hermaphrodite and dichogamous in nature, both the male and female flowers are borne in the same flower, but the female part matures before the male part (protogyny) in most of the species, therefore the annonas possess highly cross pollination.
- Natural pollination in annona mainly carried by only through insects, such as beetles (canthrophily), nitidulid beetles (*Carpophilos domidiatus* and *C. hemipterous*) play a major role in pollination of sugar apple, insects rarely visits the annona flowers because the flowers are not attractive and have low mild fragrance to attracts the insects, which suggests that canthorophylous pollination plays only a secondary role in the annona species. Because pollen grains occur in clumps and are somewhat sticky, wind pollination is not common. Although dichogamy and the low population density of pollinators insects are important limiting factors to successful natural pollination, the effect of these factors may result in fertilization failure of all or several ovules, resulting in small or asymmetrical fruits, which obviously affects the yield, quality and commercialization of annona fruits.
- Hand pollination is the only certain strategy to ensure commercial production, since it guarantees significantly higher production and better fruit quality than open/natural pollination in annona. Hand pollination improves fruit set and substantially boosts fruit yield per tree by increasing the fruit size and number, the major yield components.
- Hand pollination is normally carried out before 8.00 am using a small brush. Pollen can be collected in the morning between 5.00 and 8.00 am from fully open flowers, when the sacs have turned from white to cream. The collected pollen is used to pollinate half-open flowers whose pistils are already receptive.

(Continued on page 8...)

Sunburn in Dragon Fruit



Dragon fruit is sensitive to intense sunlight, air temperature $>35^{\circ}\text{C}$ accompanied with low relative humidity. The initial symptoms are yellowing, tissue necrosis with watery lesions & subsequent drying of the leaves. This is generally observed during April and May months of hot summer. The watery lesions harbour complex microflora leading to various bacterial & fungal infections. As soon as the cloudy weather of monsoon initiates in June, the plants revive quickly. Therefore, further investigations are required to assess the losses due to sunburn.

Reasoning sunburn disorder:

Dragon fruit (*Hylocereus undatus*) is a perennial, epiphytic, climbing cactus. Dragon fruit received significant attention for its potential as a new exotic fruit crop. However, dragon fruit is considered a promising crop to be grown commercially in dry regions. This species is found to have high water-use efficiency. One of the mechanisms to secure water requirement is developing aerial roots from the sides of the stem to collect water from the surroundings. In addition, it is characterized by a crassulacean acid metabolism (CAM) pathway that improves water-use efficiency.

The most important benefit of CAM to the plant is the ability to leave most leaf stomata closed during the day. Plants employing CAM are most common in arid environments, where water comes at a premium. Being able to keep stomata closed during the hottest and driest part of the day reduces the loss of water through evapotranspiration, allowing such plants to grow in environments that would otherwise be far too dry. Plants using only C3 carbon fixation, for example, lose 97% of the water they uptake through the roots to transpiration.

Transpiration is termed as a necessary evil because besides water loss it serves to evaporatively cool plants. The evaporating water carries away heat energy due to its large latent heat of vaporization. However, in dragon fruit lack of transpiration during day time does not allow dragon fruit leaves to cool evaporatively & continuous increase in leaf temperature leads to sun burn.

Strategies to avoid sunburn:

- Shade netting was tried earlier at NIASM orchard that needs further investigation and may be one of the option to reduce sunburn in dragon fruit. However, its cost effectiveness needs to be studied.
- As per the field experience it has been observed that the sunburn occurs more if orchard is irrigated during summer. Also it is reported to be more severe in orchards in black cotton soil. The sunburn occurrence is less when the dragon fruit orchard is in water stress. Therefore, it is being advised to not to irrigate orchard during summer.
- Some farmers have tried engaging fogger system in orchard to reduce temperature and increase the humidity. However, its cost effectiveness have to be studied.
- Dragon grows well in partial shade. Therefore, some farmers have planted drumstick in dragon fruit orchard to provide shade to the plants. This gives additional benefit from these plants.





Shredder use in sugarcane fields for trash management



Threshing of general wheat crop from D-5,6 & E5 fields



Pheromone trap for army worm in experimental maize



Bearing Jack Fruit tree along main road



Beautiful look of indoor landscape plantations



Release of 1st 'Farm Coordinator' on 12th Foundation day



From page 6 -

Improving fruit set in Custard Apple:

- As discussed in floral biology, in spite of profuse flowering in custard apple from March onwards, the fruit set is very low due to hot and dry weather. While in regular season the flowering and fruit set gets hampered due to prolonged return monsoon showers.
- Early fruit set may be achieved by altering the microclimate through water sprays, sprinklers and/ or sowing of some intercrops. Out of this the water spraying trial is already being implemented at J6 orchard.
- Some protective covers to plants may also be tried to reduce impact of sunlight and hot air breeze that may be responsible for pollen sterility and desiccation of stigma to hamper its receptivity and fertilization.
- Hand pollination can be practiced to reach most and more flowers with viable pollens to cover whole stigma for better fertilization for better uniform size fruiting.

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