





# Annual Report, 2022



**ICAR-Central Institute for Arid Horticulture**  
**Beechwal, Bikaner- 334006 (Rajasthan)**



**Correct Citation:**

**Annual Report 2022** ICAR-Central Institute for Arid Horticulture, Bikaner-334006 (Rajasthan), India

**Published by**

Director

ICAR-Central Institute for Arid Horticulture

Sri Ganganagar Highway, Beechwal, Bikaner-334 006

Rajasthan, India

Telephone : +91 151 2250147, 2250960, 2250145 (Fax)

E-mail : [ciah@nic.in](mailto:ciah@nic.in)

Website : <https://www.ciah.icar.gov.in>

**Compiled and edited by**

Dr. D. K. Samadia

Dr. D. K. Sarolia

Dr. D. S. Mishra

Dr. Ramesh Kumar

Sh. J. S. Gora

Dr. Lalu Prasad Yadav

Dr. Hanuman Ram

Sh. P. P. Pareek

Sh. B. R. Khatri

**Laser setting, designing and photography**

Sh. Bhoj Raj Khatri

Sh. Sanjay Patil

**Printed By**

R. G. Associates

Bikaner

**Disclaimer/copyright**

All rights are reserved. No part of this book shall be reproduced or transmitted in any form by print, microfilm or any other means without written permission of the Director, ICAR -CIAH, Bikaner.

## CONTENT

S.No.	Particulars	Page No.
	Preface	
1.	Executive summary	1
2.	Introduction	11
3.	Research Achievements	12
4.	Externally Funded Projects	59
5 (a).	Transfer of Technology	61
5 (b).	SCSP and TSP activities	70
6.	Training and Capacity Building	74
7 (a).	Empowerment of women	82
7 (b).	Person with Disability (Divyang)	83
8.	Award and Recognition	84
9.	Publication	90
10.	Research Project	101
11.	RAC, IMC and IRC	104
12.	Linkages and Collaboration	105
13.	Rajbhasha	106
14.	Distinguished Visitors	109
15.	Personnel	110
16.	Budget	118
17.	Seed and Planting Material	119
18.	Meteorological Data	121



# ICAR-Central Institute for Arid Horticulture

Beechwal, Bikaner-334 006, Rajasthan, India



**Dr. Jagadish Rane**  
Director

## Preface

It gives me an immense pleasure in bringing out the Annual Report 2022 of the ICAR-Central Institute for Arid Horticulture(CIAH), Bikaner. Some of the features such as vast area, ample solar radiation, relatively low incidence of diseases and pests promise to make arid and semi arid regions potential hubs for horticultural crops if appropriate technologies are developed and made available for farmers. Hence, ever since its establishment on 1<sup>st</sup> April 1993, ICAR-CIAH at Bikaner is dedicated to serve the farmers and stakeholders by engaging itself in development improved crops, novel crop production technologies, nature friendly crop protection technologies and remunerative post-harvest technologies to make the horticulture profitable component of rural economy of arid and semi arid region. The production of high quality seed and planting materials of the the horticultural crop plants and the persistent extension efforts have significantly enhanced the farmers income in these regions while institutes technologies are contributing to climate resilience.

The present report provides glimpses of research programmes and externally funded projects including research accomplishment, significant advisory services, human resource development, linkages established with various ICAR institutes, SAUs, line departments and voluntary organizations of India. This is the collective efforts of all the members of the Institute Research Council (IRC) , technical personnel, administrative, finance and supporting staff of the Institute who contributed significantly in moving the research and outreach programmes of the Institute forward.

I take this opportunity to place on record my sincere thanks and deep sense of gratitude to Dr. Himanshu Pathak, Secretary, DARE and Director General, ICAR for his constant support in executing the mandate of the Institute. I also express my gratitude to Dr. A. K. Singh, Deputy Director General (Horticultural Science) and Dr. V. B. Patel, ADG (Fruits and Plantation Crops) for their critical remarks and valuable suggestions. Dr. D. K. Samadia, Principal Scientist deserves appreciation for his significant contribution in guiding the staff during his tenure as Acting Director.

This Annual Report is the culmination of dedicated and sustained efforts by our scientists and staff of the institute both at Bikaner and Experimental Station at Vejalpur, Godhra. I wish to express my sincere appreciation to Dr. D. K. Sarolia, Dr. Ramesh Kumar, Sh. J. S. Gora, Dr. Hanuman Ram, Sh. P. P. Pareek and Sh. B. R. Khatri as well as staff o regional centre particularly Dr. D. S. Mishra and Dr. Lalu Prasad Yadav for their sincere and whole-hearted support in bringing out the Annual Report 2022.

28 March, 2023  
Bikaner

(Jagadish Rane)



## 1. EXECUTIVE SUMMARY

### Plant Genetic Resources and Crop Improvement

ICAR-Central Institute for Arid Horticulture is a leading research organization working on arid and semi-arid fruits and vegetables crops. The diverse germplasm of various arid fruits (1784) and vegetable crops (1109) were collected, conserved and being evaluated at the field gene bank of ICAR-CIAH, Bikaner, Rajasthan and its regional station CHES, Vejalpur, Gujarat. During reporting period, 28 diverse and trait specific germplasm of arid fruits and 32 germplasm of arid vegetables were collected for further evaluation and utilization in breeding programme. During this period, nine varieties of arid horticulture crops (3 fruits and 6 vegetables) were identified at institute level adding to total varietal strength (58 arid horticultural crop varieties) of ICAR-CIAH, Bikaner.

In ber, eight accession of *Zizyphus rotundifolia* (bordi) having specific trait like suitability for dehydration, thornlessness and fruit quality were collected from farmer's field of Udairamsar area of Bikaner district. Two genotype of acid lime from Dang and one from Bharuch district of Gujarat were collected. Two accessions of karonda from Ayodhya (UP) and Vejalpur (Gujarat) were collected for further evaluation. One germplasm of ker 'AHCD/KK-19' was collected from Sikar, Rajasthan and conserved in the field repository for further evaluation. One germplasm of lasoda 'AHCM/KK 22' was identified and conserved in field repository for further evaluation. Eight promising genotypes of pilu were identified from different areas of the Jaisalmer district. The diverse germplasm of jamun (02), phalsa (01), manila tamarind (02) and seeds of tendu from Panchmahal, Dang and Bharuch districts of Gujarat were collected. The arid vegetable crops, systemic survey was carried out and collected 10 genotypes of okra, 12 genotypes of chilli, 6 germplasm of cucumber, 3 germplasm of pumpkin (mini box type) and one of drumstick were collected based on their morphological traits.

In arid vegetable crops two varieties (Ridge gourd - Thar Karni and Longmelon - Thar Sheetal) were notified vide Gazette Notification number S.O. 3254 (E) dated 20-07-2022 for commercial cultivation in Rajasthan state. Thar Karni (Ridge gourd) is early in harvesting and takes 51-55 days to first picking from sowing. Fruits 20-25 cm long weighing 90-110 g and cylindrical with 10 longitudinal shallow ridges. Yield potential is 180-240 q/ha. It is suitable for cultivation during spring-summer and *kharif* seasons. It is tolerant to high temperature and mosaic disease under field

conditions. Thar Sheetal (Longmelon) is early in harvesting and took 45-50 days in first harvesting from sowing. It produced 25-30 cm long fruits which are light green at tender and edible stage. The fruits are free from bitterness. It is equally suitable for cultivation in spring-summer and *kharif* seasons under open field conditions. Yield potential varied from 150-200 q/ha. It is able to set fruits at high temperature during summer season under hot arid conditions.

In arid fruit crops, three varieties were identified at institute level i.e. wood apple -Thar Prabha, custard apple-Thar Amrit and acid lime-Thar Vaibhav. Wood apple variety Thar Prabha found promising under semi-arid condition. It has fruit weight 380.12g and 19.80°B TSS. The fruit start ripening from 2<sup>nd</sup> fortnight of December and it come under late maturity group. The average fruit yield was recorded 170.00 kg/plant in 15<sup>th</sup> year plant age under rainfed conditions of hot semi-arid ecosystem. Custard apple variety Thar Amrit found promising under semi-arid condition. It is regular bearer and ripens in 1<sup>st</sup> fortnight of November. Genotype has 320.12 g average fruit weight, 63.58% fruit pulp and 29.12°Brix TSS. The average fruit yield per plant was recorded 24.80 kg during 11<sup>th</sup> year after planting under rain-fed conditions of semi-arid ecosystem. Thar Vaibhav is a precocious and prolific bunch bearing variety of acid lime having vigorous and spreading growth habit. Fruits are round with attractive yellowish smooth peel. Fruit is juicy (49 %), acidic (6.84 %) with less number of seeds/fruit (6-8). It is high yielder with an average yield/plant of 60.15 kg during 6<sup>th</sup> year of planting under rainfed hot semi-arid conditions. It has fruit weight 42.57 g, TSS 7.34°Brix and ascorbic acid 43.45 mg/100 ml with excellent keeping quality at ambient storage.

In arid vegetable crops, six varieties were identified at institute level i.e. Thar Mahima (Muskmelon), Thar Kiran & Thar Ganga (Dolichos bean), Thar Jyothi (cowpea), Thar Dipti (Ivy gourd) and Thar Amruta (Khejri). Thar Mahima has high TSS (11.58-11.80%) and fruit weight 780-900 g with salmon orange colour. It produced 4-5 fruits per plant which are round and attractive with netted surface having sutures. It is responsive to low tunnel and net house cultivation. It produced marketable fruit yield of 193.7q/ha. Thar Kiran has purple pigmentation in their stem, petiole, flower, leaf veins and pod. A total of 1100-1600 pods per plant with yield of 7-9 kg/plant of fresh purple pods are harvested under dry land semi arid conditions with yield potential of 60-63 t/ha. It is rich source of anthocyanins (190 mg/100 g) and proteins (5.4 g/100 g).



Thar Ganga has attractive long green pod appearance and heavy bearer. The pod weight is 15.2 g with average yield of 8-10 kg/plant. It has higher nutritional value in terms of proteins (4.8g/100 g), vitamin C (7.2 g/100g),  $\beta$ -carotene (12.8 mg/100g) and total antioxidants (345.5 mg AAE/100g). Thar Jyothi is a photo insensitive type, short stature (50-56 cm height) having dark green leaves and pods which can be cultivated round the year under semi arid conditions. It has pod weight 9.65g, yield 1.5 to 2.0 kg/plant of fresh pods with yield potential of 20-25 t/ha. It is rich in proteins (4.82 g/100), ascorbic acid (55.8 mg/100g) and nutrients.

Thar Dipti (Ivy gourd) vines are vigorous, densely foliated with dark green trilobed leaves, high yield potential during summer season. No disease/serious pest incidence is found at field condition and tolerant to heat stress as well as drought under hot semi-arid conditions. It is propagated through stem cuttings. It matures in 51-56 days after planting, fruits/vine 1497, fruit weight 14.2 g with yield 24.4 kg/plant and 19.92 t/ha. It is suitable for culinary purpose. Thar Amruta (Khejri) has plant height 3.81 m (6<sup>th</sup> year), spreading in nature, and economic sangri harvesting started at 3-4 year age. Dehydrated pods rich in nutraceutical value and contains 50.2% carbohydrate, 17.2% protein, 1.8% fat, 23.7% crude fibre, 3.2% calcium, 0.4% phosphorus and 3.9% trace elements. It yield green pods 5.88-6.68 kg per plant (35.12 q/ha) at 7-8 year old plant, dry leaves 6.72-8.23 kg/plant (37.37 q/ha) and fuel wood 9.23-11.25 kg/plant. Tender pods at marketable stage are light green, straight, roundish-flat and weight is 0.852 to 1.796 g. It tolerates extremes high (50 C) as well as low temperature (-6 C).

Seventy pomegranate germplasm were evaluated and found statistically significant for growth, fruit quality and aril attributes during *mrig bahar* under hot arid condition. Maximum number of fruits per plant was obtained in Bhagwa (50.35) followed by Saharanpur (49.10), Jalore Seedless (48.50), Jalore Red (42.50), Jodhpur Red (41.25) and Mridula (40.10). Number of cracked fruits per plant was recorded maximum (15.50) in Saharanpur followed by Mridula (10.30) and very less number of cracked fruits per plant was observed in sour type deciduous germplasm like Gul-e-Shah Rose Pink (1.00), Gul-e-Shah Red (1.00), Gul-e-Shah (2.00) and Sur Sukker (2.00). Maximum fruit weight was recorded in Jalore Seedless (285.06 g) followed by G-137 (269.62 g) and Jodhpur collection (260.19 g) while minimum fruit weight was recorded in Yercaud Local (96.19 g) and MR 599 (101.59 g).

Promising pomegranate selections were evaluated under hot arid condition. CIAH PG-1 has fruit weight 250 g, aril weight 35.50 g/100 arils,

acidity 3.6%, TSS 14.36°Brix and fruit yield 20.67 kg/plant. It found highly suitable for anardana purpose due to high acidity of juice with high anardana recovery. CIAH PG-2 has fruit weight 235.12 g, aril weight 27.50g/100 arils, TSS 16.05°Brix and fruit yield 15.50 kg/plant. It found highly suitable for table purpose. CIAH PG-3 has fruit weight 250-260 g, arils colour light pink, seed hard and very attractive crown at harvest and can be used as breeding material. CIAH PG-4 has fruit weight 90-120 g, fruit colour dark purple (rich in anthocyanin 202.72 mg/g), arils colour light purple and slightly sweet and hard arils. CIAH PG-5 plants are semi-vigorous, evergreen growth habit, very less or no spines (1-2/m of length) produce very less suckers (2-3/plant) and having no fruit setting.

Six pomegranate germplasm/varieties were evaluated for rind and aril quality attributes. The rind anthocyanin content was found maximum in CIAH PG-4 followed by Mridula as compared to minimum in Jalore Seedless. The aril juice anthocyanin content was found maximum in Mridula followed by CIAH PG-1 as compared to minimum in Ganesh.

The four elite male date palms were evaluated for pollen production under hot arid climatic conditions. CIAH/DP/M-1 produced highest pollen (730.86 g/plant). Thirty eight genotypes of date palm were evaluated for morphological, yield, fruiting, and quality attributing characters. Highest TSS was recorded in Medjool (52.6 °Brix) as against lowest in Zaglool (19.6 °Brix). Yield was found maximum in Zahidi 86.6 kg/palm and minimum in Sakloti (8.10 kg/palm).

In date palm promising germplasm evaluation, Dhamas genotype has been identified promising for early maturing in the month of June with 90% soft fruits before onset of monsoon. The yield of plant was 40-50 kg with TSS 50.2°Brix. This genotype is highly suitable for soft date (pind khajoor) preparation. CIAH/DP/F2 is an early to mid-season (second week of July) ripening genotype which possessed crunchy in taste and suitable for fresh consumption at doka stage with 75 kg yield/palm. CIAH/DP/F1 and CIAH/DP/F3 are rain tolerant genotypes of red colour berry, suitable for fresh consumption and preparation of processed products.

Fourteen genotypes of aonla were evaluated under semi arid condition of Gujarat. Plant height (4.05 m) was recorded maximum in CHESA-4 followed by CHESA-7 (3.95 m) and it was recorded least in CHESA-1 (3.41 m) whereas yield per plant was recorded the maximum in CHESA-4 (45.60 kg) under rainfed semi-arid conditions.

In bael, 149 genotypes were evaluated under rainfed semi arid condition of Gujarat. Genotypes exhibited variability in terms of fruit

yield/plant (68.11-145.10 kg), fruit weight (0.61-2.54 kg) and for chemical composition including pulp TSS (33.20- 41.00°Brix), acidity (0.30-0.58%), ascorbic acid (12.12-23.75 mg/100g). Based on the observation on various aspects particularly fruiting pattern and quality attributes, genotypes, viz., CHESB-27, CHESB-29, CHESB-31, CHESB-42 and CHESB-48 were found superior under rainfed semi-arid ecosystem.

In evaluation of wood apple genotypes under rainfed semi arid condition of Gujarat, maximum fruit weight was recorded in Thar Gaurav (445.00 g) followed by Thar Prabha (388.10 g) while it was minimum in CHESW-7 (165.12 g). The fruit yield per plant was noted highest in Thar Prabha (160.0 kg) followed by CHESW-4 (129.27 kg) and Thar Gaurav (130.12 kg) whereas it was found minimum in CHESW-1 (61.00 kg). The genotype CHESW-2, CHESW-6 and CHESW-10 were found to be promising on the basis of qualitative and yield traits.

Forty seven custard apple germplasm were evaluated under rainfed conditions of semi-arid ecosystem. The wide variation was recorded in fruit quality attributes viz., fruit weight (122.12-335.30 g), pulp percentage (41.23-64.51%), fruit pulp color (creamy white to dull white), pulp texture (soft to gritty), TSS (24.00-32.10°Brix), acidity (0.24-0.57%), shelf life (3-5 days) and yield (14.00-32.70 kg/tree). Among the evaluated germplasm CHESCA-13, CHESCA-23 and CHESCA-27 were found superior for fruit quality and yield characters.

In acid lime germplasm evaluation at CHES, Vejalpur, acid lime accession CHESL-15 recorded the highest fruit weight and juice content. The highest juice percentage was recorded in CHESL-29 followed by CHESL-15 and CHESL-22. The highest acidity was observed in CHESL-12, while Ganganagar-1 recorded the minimum acidity. However, the highest average yield/tree was observed in CHESL-12 followed by CHESL-15 and Pramalini.

Fifteen promising genotypes of jamun were evaluated for flowering, fruiting and fruit quality attributes under semi-arid condition. Fruit yield was found maximum in CHESJ-30 (36.36 kg/plant) followed by CHESJ-38 (34.22 kg/plant), CHESJ-32 (33.43 kg/plant) and minimum in CHESJ-34 (18.16 kg/plant). Improved fruit quality parameters were recorded in CHESJ-30.

In evaluation of red fleshed guava germplasm under semi-arid condition, maximum fruit weight was observed in H-2 (236.03 g) and minimum was recorded in Bhavnagar-2 (108.15 g). The highest TSS was recorded in Bhavnagar-2 (14.89°Brix), while the minimum in CHESG-30 (9.79°Brix). Ascorbic acid was observed highest in H-1 (278.86 mg/100 g), while Ratandeeep recorded the minimum ascorbic acid (115.30 mg/100 g). The

pectin content was ranged between 0.82 % in CHESG-31 to 1.30 % in Suv Pink.

White fleshed guava germplasm were evaluated under semi-arid condition. The fruit weight was ranged from 118.35 g in MPUAT-1 to 238.50 g in CHESG-38. The maximum number of fruits/tree was observed in MPUAT-1 (215) followed by CHESG-38 (155) while least in Dhawal (50). Highest fruit yield/tree was recorded in CHESG-38 (36.90 kg) followed by L-49 (30.50 kg) while least in Dhawal (7.15 kg). The maximum TSS was recorded in CHESG-39 (14.35°Brix) while minimum in Seedless (10.40°Brix). The pectin content was ranged between 0.85% in CHESG-1 to 1.57% in VNR Bihil.

In tamarind, twenty four genotypes were evaluated for growth, flowering, fruiting and fruit quality attributes under semi-arid condition of Gujarat. On the basis of fruit yield and quality attributes, CHEST-10 was found promising. It has up right growth habit, thick trunk and drooping branches. It recorded 85.0-100.0 kg fruit per plant. Peak period of ripening time was last week of March. It recorded 52.20 pulp percentage and 70.30°Brix TSS at ripe stage.

Ten tamarind varieties were evaluated under semi-arid condition. The maximum fruit yield (55.65 kg/plant), pod length (14.55 cm) and pulp content (51.78 %) was recorded in Goma Prateek, while maximum TSS (68.44°Brix), total sugar (49.92%) and lowest acidity (8.43%) were recorded in Urigum.

In jamun, four varieties were evaluated under semi-arid condition, maximum plant height was recorded in CISHJ-37 (6.14 m), followed by CISHJ-42 and Goma Priyanka. Stock and scion girth was found maximum in CISH-37 closely followed by CISHJ-37. Fruit yield was recorded maximum in Goma Priyanka followed by CISH 37. Minimum fruit yield per plant was noted in CISH 42. Maximum fruit weight and pulp content was recorded in Goma Priyanka closely followed by CISHJ-37.

In manila tamarind, 30 genotypes were evaluated under semi-arid condition of Gujarat, maximum panicle length, fruit weight 30.00 g with 73.00 % pulp and yield 14-17 kg/plant was recorded in CHESM-4, while highest TSS was recorded in CHESM-12 (25.10 °B). In ker, sixteen genotypes were evaluated for morphological characteristics under hot arid condition. Genotype AHCD-3 registered maximum plant height (4.97 m) followed by AHCD-1 (4.91 m) and minimum in AHCD-15 (2.03m). Maximum fruits per cluster at pea stage (4.4) were observed in genotype AHCD-1 and minimum (1.8). Fruit weight at ripe stage was varied from 1.36 g (AHCD-10) to 6.27 g (AHCD-5).

In pilu, eight promising genotypes were

identified from Jaisalmer district of Rajasthan. The identified genotypes showed significant variation in leaf blade length (4.27 to 8.58 cm), leaf blade width (0.68 to 8.58 cm), leaf thickness (0.18 to 0.44 mm), petiole length (4.52 to 8.14 mm) and petiole diameter (0.66 to 0.94 mm). The fruit is a drupe, sub-sessile, delicate, fleshy, and transparent when mature. Further, the identified genotypes also showed significant variation in TSS ranging from 17.52 to 27.76°B with an average of 21.84°B.

In improvement of ber through hybridization, cross combinations with different cultivars of *Ziziphus mauritiana* i.e. Gola x Reshmi, Seb x Reshmi, Gola x Kathaphal, Gola x Reshmi, Gola x Mehrun, Gola x Tikadi, Tikadi x Gola were attempted (360). In these combinations Gola x Reshmi and Gola x Mehrun showed maximum crossability followed by Gola x Kathaphal, but there was no fruit set between Seb x Reshmi, Gola x Tikadi and Tikadi x Gola. In Thai ber improvement, crosses between Thai and other ber varieties were attempted with the objective to improve in TSS (donor parent Reshmi) and fruit shape-colour (donor parent Kathaphal) in Thai. Total 764 crosses were attempted and set fruits twenty six that is 3.40 per cent of total crosses. Fruits retained till maturity of Thai x Reshmi, Thai x Kathaphal and Selfing of Thai.

In interspecific hybridization in ber, total 120 crosses were attempted between *Ziziphus mauritiana* cultivar i.e. Gola and Seb with *Ziziphus nummularia* (used as a donor parent) to develop trait specific genetic material i.e. early maturity, frost and drought tolerance in the hyper arid condition. Fruit set registered 6% in the combination of Gola (*Z. mauritiana*) x *Z. nummularia* but no fruit setting with the combination of Seb (*Z. mauritiana*) x *Ziziphus nummularia*.

In pomegranate improvement through hybridization, a total of 154 crosses were attempted including Jalore seedless, Bhagwa, Mridula and Ruby pomegranate cultivars and selection CIAH PG-4 and AHPG C-1 to develop fruit cracking tolerance and quality improvement of pomegranate under hot arid region. All the pomegranate cultivars in which hybridization was done were found to be cross compatible. Fruit set in different cross combinations ranged from 7.14% to 28.57%. Maximum fruit set was recorded in cross G-137 x Gul-e-Shah Red (28.57%) while minimum fruit set was recorded in cross Jalore seedless x CIAH PG-4 (7.14%).

In development and maintenance of hybrid seedling population of pomegranate from selected parents, crossed fruit were harvested at their maturity and seed were separated from the fruit and sown for development of progeny populations. A total of 52 (nos.) progeny plants were obtained from different cross combination. They are grown under

controlled condition and transplanted in the field for further evolution purpose.

In evaluation of promising genotype of acid lime, CHESL-29 has less thorn density with less incidence of citrus canker. It is cluster bearer with 42.43 g fruit weight and 42.0 kg yield/plant. It has 53.30% fruit juice, 6.97°Brix TSS, 6.56% acidity and 41.67 mg/100 ml ascorbic acid.

CHESL-32 recorded 30 kg yield/plant with fruit weight 39 g, TSS 9.09°Brix, acidity 8.18%, TSS: acidity 1.11 and ascorbic acid 30 mg/100 ml. Keeping quality of fruits is good at ambient storage (8-10 days) with attractive yellow smooth peel. CHESL-15 registered 46.18 kg yield/plant with fruit weight 40 g, juice 51.39%, TSS 7.86°Brix, acidity 6.87%, TSS: acidity 1.14 and ascorbic acid 38.17 mg/100 ml. Keeping quality of fruits is good at ambient storage (8-10 days) with attractive yellow smooth peel.

In performance evaluation of guava promising genotype/varieties, H-1(CHESG-15 x Thai found prolific bearer (35.50 kg/tree), fruits are round in shape, weight (250-280 g) with smooth, yellowish green peel and red pulp. H-2 (CHESG-15 x Thai) produced (39.50 kg/tree) yield, fruits are round, medium fruit weight 250-280 g with smooth, yellowish green peel and pulp is light red. While CHESG-38 has fruit weight 220-240 g and average yield 37 kg/tree during 6<sup>th</sup> year. Fruit peel is whitish yellow in colour and shelf life of fruits is good at ambient storage (5 days). Performance of F<sub>1</sub> progenies of guava was evaluated. Among different cross combinations, VNR x CHESG-15 (2.95 m) and Thai x MPUAT-2 (2.78 m) produced the tallest canopy height and spread in comparison to other crosses. Fruit weight, size, seed core diameter, pulp thickness and other fruit quality characters also varied among progenies.

Sweet orange cv. Mosambi and Sathgudi were evaluated on different rootstocks under hot arid condition, Rangpur lime (162.42) and Volkamericana (163.42 cm) had the highest plant heights of Mosambi. However, Sathgudi plants registered maximum heights on Karna Khatta rootstock (163.33 cm) followed by Rangpur Lime (134.00 cm) and Rough lemon (120.40 cm), while Pectinifera recorded their shortest height (70.17 cm). The rootstocks Sour orange (100%) and Rough lemon (57.17%) had the highest and lowest scion survivability rates, respectively. In sweet orange, ten varieties were evaluated under hot arid region. In terms of growth and canopy features, Sathgudi, Hamlin, and Jaffa ranked highest, while Valencia Olinda and Pineapple cultivars scored lowest. Additionally, the Sathgudi cultivar generated the highest fruit production and the earliest fruit harvesting; the pineapple produced the lowest fruit yield. Thus, under irrigated hot arid climate of Rajasthan sweet orange cv. Sathgudi was found superior over other cultivars.

Mandarin var. Fremont was evaluated on four rootstocks under hot arid condition. The stionic ratio was highest in the Fremont/Pectinifera, while the lowest was found in the Fremont/Troyer citrange combination. The Karna Khatta rootstock had higher fruiting density, heaviest fruits, maximum numbers of fruit and fruit yield followed by Pectinifera rootstocks, while all these parameters were found lowest in Troyer Citrange. A positive significant correlation was found in Karna Khatta and Rough lemon for higher growth and yield attributes; fruit quality parameters in Pectinifera.

In velvet bean, the performance of a unique germplasm AHVB-1 was evaluated after 10 years as repeated experiment. It is vigorous in plant growth and prolific in pod bearing. The genotype bears 12-15 clusters/plant and 7-14 pods/cluster. Tender pods at marketable stages are green in color with velvety surface having tiny hairs. Mature pods recorded 32-40 g weight, 11.412.6 cm length and 1.9-2.4 cm width. Each pod containing 5-6 seeds which are dark brown in color, 1.7-2.1 cm length and 1.21.4 cm width. Crop damaged completely due to severe low temperature (-4°C) and frost conditions observed on 16 January 2022 at CIAH farm.

During the rainy-winter season, AICRP (VC) entries of cowpea (7) and brinjal (13) were assessed for genotypic performance and yield potential as AVT-I under hot arid climate. Trials consisted of two entries each from CIAH, Bikaner *i.e.* cowpea (AHCP-1-4-1 and AHCP-2-3) and brinjal (Thar Rachit and CIAH-22) developed for unique quality and yield under heat stressed arid environment.

In watermelon, five advance lines were evaluated during summer season for horticultural traits. AHW/BR-22 produced oblong fruits with 2.6-3 kg fruit weight. Flesh colour is red having 11.7-12.4% TSS. AHW/BR-25 is characterized by entire (non-lobed) leaves. Fruits are round with fruit weight 2.5-3.6 kg and TSS 11.5-12%. AHW/BR-43 PL5 characterized by 1.8-2 cm long ovary, 28-32 cm long fruits having light green rind with very narrow stripes, dark red flesh and bold seeds. The fruit weight, diameter, rind thickness and TSS varied from 3-4.5 kg, 16.5-18 cm, 1.5-1.8 cm and 11-11.8%, respectively. AHW/BR-43 PL8 has fruit weight 3.8-4 kg with fruit length 30-32 cm. Flesh colour is red with TSS 11.6-12%. YF 5-2-7 is characterized by entire (non-lobed) leaves and saffron coloured flesh (Yellow orange group 21 C). Flesh is high in carotenoid content (9.22 µg/g FW). Fruits are round weighing 2.6-3.0 kg having dark green rind with very narrow stripes.

In *Momordica balsamina* L., a promising line (CIAHMB-1; IC-0644742) was evaluated which produced 200-230 fruits per plant. The fruit weight, diameter and length ranged from 7.30-9 g,

2.1-2.6 cm and 3.2-4.5 cm, respectively. The length of ovary varied from 0.4-0.7 cm. Recorded 10.9-15.2% dry matter content in fruits at edible stage. Also conducted an evaluation trials on CIAHMB-1 at KVK, Phalodi and KVK, Chomu which produced 40-50 and 31.75 q/ha yield, respectively.

In muskmelon 30 germplasm were evaluated during the summer season which showed wide genetic variability with respect to different qualitative and quantitative traits. Fruit weight was ranged from 0.5 to 1.2 kg, fruit diameter 10.5 to 13.2 cm, no. of sutures 8 to 12 and TSS ranged from 8.0 to 13.8%.

In Dolichos bean promising genotypes were evaluated under semi-arid condition of Gujarat. CHESDB 31 has are attractive light greenish white pods of 14.23 cm length with pod weight of 8.5g and average yield of 6-7 kg/plant of fresh pods. CHESDB-01 has attractive long flat, green pod colour and average yield of 6-6.5 kg/plant of fresh pods. CHESDB-10 pods are very attractive creamy whitish green in colour. The pods are broad, having pod weight of 11.5g and average yield of 6.5-7.5 kg/plant of fresh pods. CHESDB-40 pods are light purple in colour. The pods are sickle shaped, pod weight of 7-7.5 g with yield of 7.0 to 8.5 kg/plant of fresh pods. This genotype found field resistance to dolichos bean yellow mosaic virus disease under field conditions.

Promising genotypes of vegetable cowpea were evaluated under semi-arid condition of Gujarat. CHESVC-01 has attractive long parrot green pod appearance. It is an early flowering and early maturing genotype with yield of 2-2.5 kg per plant of fresh pods. CHESVC-22 pods are attractive red in colour, pod length of 36.8 cm and pod girth of 2.6 cm with pod weight of 13.2 g. The fresh tender red pods were harvested at 64-65 days after sowing. CHESVC-45 pods are attractive red in colour and cluster bearing with pod weight of 9.2 g.

In yard long bean, promising genotypes were evaluated under semi-arid condition of Gujarat. CHESVC-15 has dark red pods. It is an early flowering and maturing genotype. It has 22.0-23.0 g pod weight with an average yield of 2.0 to 3.0 kg/plant of fresh pods. CHESVC-16 is an early flowering and maturing genotype. The pods are attractive light green in colour having 28.0-30.0 g pod with yield of 2.5 to 3.5 kg/plant of fresh pods. CHESVC-20 is a bush and photo insensitive type genotype. It is having short stature (bushy growth habit) grows up to of 40-50 cm height. Pods are pale green in colour, having pod weight of 5.80 g with yield of 0.8- 1.0 kg/plant of fresh pods.

The cluster bean genotypes were evaluated for their morphological, yield and quality attributes under rainfed semi-arid conditions. Among them, the genotypes like CHESCB-60, CHESCB-59, CHESCB-25 and CHESCB-24 are superior with respect to fresh number pods and pod yield.

CHESCB-25 has single stem growth behaviour, green colour pods with pod weight of 3.93 g and average yield of 1.2 kg/plant of fresh pods. CHESCB-24 has single stem growth behaviour with green colour pods, pod weight of 3.12 g and yield of 1 kg/plant of fresh pods.

The promising lines of bottle gourd viz. LS-20-1xLS14-1, LS-28xLS-20-2, LS3xLS-2, LS42xLS32-2 and Baina along with varieties (Thar Avani, Thar Samridhi, Pusa Sandesh and Arka Bahar) were evaluated for different horticultural traits. The line LS-28xLS-20-2 (long type) recorded 19 fruits/plant and 15.6 kg/plant yield.

In spine gourd, twenty eight genotypes were evaluated under rainfed semi-arid conditions. Three accessions were found elite namely CHESG 1, CHESG 11 and CHESG 15. The accession CHESG 1 recorded fruit weight (15.4-20.6 g), less seeded (16-20), high yield potential (1.6-2.8 kg/plant) with dark-green and round fruits along with small spines attributing to consumer preference. CHESG 11 recorded round oblong fruit shape, natural dark green colour, styler end deeply pointed with average fruit weight (30.5 g) and fruit yield (2.59 kg per plant). CHESG 15 recorded conical shape small sized fruit, very small and soft (feathery) spines, and soft seeded with fruit weight (5.5 g) and length of fruit (2.3-2.8 cm).

In evaluation of chilli genotypes under hot arid condition, a wide range of variability was observed with respect to various morphological traits viz., plant height (29.21-116.84 cm), number of fruits per plant (18.47-151.16), fruit length (2.36-12.89 cm), fruit diameter (0.35-3.90 cm) and average fruit weight (1.88-15.10 g).

In evaluation of tomato germplasm under hot arid condition, a significant variation was observed for plant height (50.8-108.37 cm), days to 50 % flowering (47.84-68.54), days to first marketable harvest (82.73-118.80). The range of fruit length, diameter weight were recorded 2.35-4.24 cm, 2.28-4.22 cm and 7.29-35.39 g, respectively. Biochemical traits like TSS and acidity also showed variation (2.3-5.5 ° Brix and 0.21-0.64 %, respectively) among the genotypes.

In breeding for high temperature tolerant and fruit quality in round melon and bottle gourd, nine round melon genotypes were evaluated for vine growth, flowering, fruit-set and yield component characters. The round melon performance was repetitively found very poor as summer crop in arid climate. In bottle gourd, 52 lines were studied for viability and re-generation parameters. About 60 % genotypes exhibited very poor germination and failed to express vigour for field evaluation.

In evaluation of khejri genotypes under hot arid condition, fourteen elite genotypes identified by CIAH from 2000-2005 and collected clonally for *ex-situ* conservation in *khejri* germplasm plot

block. Khejri variety Thar Shobha and Thar Amruta studied in reference to training-pruning/lopping practices, and growth, pod yield and bio-mass production over the years under rainfed conditions. Khejri Selection-3 studied for pod quality, sangri yield and picking intervals in response to training-pruning and it was observed on 10 years old seedling plant which bears very long pods.

In evaluation of drumstick genotypes, CHES D-40 performed well and recorded 2.82 m plant height, 248 pods per plant, 216 g each pod weight, January-March pod maturity, fruit length 45-48 cm and 9-10 seed per pod under rainfed semi arid conditions. The leaves and pods of CHES D-40 recorded higher ascorbic acid, total phenols and flavonoids content. While, CHES D-34 is medium dwarf tree, soft skinned purple colour pods at tender stage suitable for processing; medium length pods rich in magnesium and zinc content. The highest antioxidant potentiality in leaves and pod were measured in CHES D-45 and CHES D-34, respectively. The pod length, number of pods and seeds per pod were maximum in Thar Harsha, but yield was maximum in CHESD-42.

### Physiological, Biochemical and Bio-technological Interventions

Nine *Cl*RBOH genes were analyzed during cold stress. Out of nine, four genes (*Cl*RBOH01, *Cl*RBOH06, *Cl*RBOH07 and *Cl*RBOH08) were up-regulated at each time point of cold stress. Similarly, *Cl*RBOH08 was shown up-regulation in case of heat stress. *Cl*RBOH genes also revealed a differential gene expression pattern under drought and salinity stress. During salinity stress, most of the genes shown down-regulation as compared to 0 h control except *Cl*RBOH01 and *Cl*RBOH02 which were up-regulated at 6 h and 72 h. These results indicated that the *Cl*RBOH gene family might have potential roles as candidate genes against abiotic stresses in watermelon.

In watermelon, 10 cultivars were molecularly characterized using 34 ScoT markers. All 34 ScoT markers were produced 197 polymorphic alleles with a range of 3 to 7 alleles per locus. The PIC value was ranged from 0.44 to 0.72 with an average value of 0.58. Similarly, the expected heterozygosity (*He*) level was observed in a range of 0.09 to 0.61 with an average of 0.34. Out of 34 ScoT markers, however, ScoT19 and ScoT20 marker has given the best result in terms of polymorphism among the 10 genotypes.

The muskmelon cv. Thar Mahima (AHMM/BR-47) was molecularly characterized using 15 CBDP markers. Out of 15 CBDP markers, twelve markers were got amplified on genomic DNA of analyzed melon cultivars and out of 12 markers, four CBDP markers namely CBDP2, CBDP4, CBDP5, CBDP7 and CBDP12 were able to produce Thar Mahima-specific bands.

In date palm, nine male date palm genotypes were characterized using 24 ScoT markers. One hundred sixty eight alleles with moderate level of PIC value (0.29 to 0.38) were produced by 24 ScoT markers in 9 male date palm genotypes. The UPGMA clustering analysis grouped 9 male date palm genotypes into two major clusters. Similarly, two major populations were inferred among 9 genotypes during population structure analysis.

In molecular characterization of 17 karonda genotypes, the profiling of ScoT and CDBP markers was done using PCR amplification of marker-specific primers. The 14 CDBP markers were produced 61 scorable alleles. The alleles were ranged from 01 to 09 alleles with 4.35 alleles per marker. Likewise, 12 SCoT markers were produced 56 scorable alleles. The alleles were ranged from 01 to 08 alleles with 4.67 alleles per marker. Fourteen CDBP and 12 SCoT markers were able to distinguish the genotypes to each other based on their polymorphic banding pattern among the genotypes. In addition to this, DNA fingerprinting of karonda cv. Thar Kamal was done using 12 ScoT and 14 CDBP markers. The banding pattern in 'Thar Kamal' cultivar was scored and fidelity of the specific bands was compared with banding pattern of 16 known genotypes. Eleven CDBP markers were able to produce 'Thar Kamal' specific bands. Out of 12 ScoT markers, five ScoT markers namely ScoT13, ScoT16, ScoT19, ScoT23 and ScoT25 were able to produce 'Thar Kamal' specific band.

To assess molecular diversity and population structures in pomegranate genotypes, 96 genotypes were characterized using 14 SSR markers. The fourteen SSR markers were produced 40 alleles with an average of 2.85 alleles per primer. The highest PIC value was exhibited by SSR P4 (0.52) whereas lowest PIC value was exhibited by SSR P13 (0.078). The heterogeneity (*He*) varied from 0.079 to 0.601 with an average of 0.5021. The highest *He* was exhibited by SSR P4 (0.601) whereas lowest *He* was exhibited by SSR P13 (0.079). The UPGMA clustering of the pomegranate germplasm was distinguished the germplasm with 0.48-1.00 Jaccard's similarity coefficient. At Jaccard's coefficient 0.48, the 96 genotypes were clustered into two major groups (Group I, Group II). The Group I is consisted with 24 genotypes. The Group II is consisted with 72 genotypes. Among the Group II, Group IIc is harboring two genotypes namely S90, S72 as outlier group.

In chilli forty-five genotypes were characterized using eight ScoT markers. The ScoT markers produced 48 alleles with an average of six alleles per locus. The allele size was ranged from 300 bp to 1500 bp. The maximum allele was amplified by ScoT7 while minimum was by ScoT11. The genotypes were clustered into two

major groups. Group I is further divided into 4 sub-groups along with 2 outliers and in group II, four genotypes showed close similarity.

In studies on tolerance and susceptibility mechanism against concurrent abiotic stresses in *Ziziphus* spp., a significant variation among seasons as well as between species was observed in all evaluated parameters. The increased accumulations of stress responsive metabolites like phenolics, flavonoids, TAA, tannins, APOX and SOD activities was observed in *Z. nummularia* during the severe summer (May-June) and winter (Dec.-Jan.) months while in *Z. mauriana* it was decreased during these months. The catalase activity was only increased during winter months in *Z. nummularia* while in *Z. mauritiana* it was increased during March and October months. The absolute values for phenolics, flavonoids, TAA, tannins, APOX and SOD activities in leaves of *Z. nummularia* was significantly higher and MDA content was significantly lower than that of *Z. mauritiana* throughout the years.

### Crop Management and Agro-techniques

In ber canopy management, four ber varieties (Gola, Thai, Goma Kirti & Thar Sevika) were trained on Y shape, espalier, telephone and modified centre leader training system. Maximum fruit yield was recorded in variety Thai followed by Goma Kirti and minimum in Thar Sevika. Among the training systems, Y shape was recorded higher fruit yield over other systems. Ber variety Thar Sevika has maximum flavonoids, total antioxidant and total soluble sugar except phenols and Thai has minimum values. Among training systems, Y shape recorded higher fruit quality components and telephone system least except for total soluble solids.

In pomegranate canopy management studies, maximum plant height (2.19 m) was recorded in single stem branching at 1 foot + 10% pruning followed by single stem branching at 1 foot + 20% pruning as compared to minimum in control (1.60 m). Canopy volume (4.34 m<sup>3</sup>), fruits/plant (51) and yield (12.75 kg/plant) were recorded highest in four stem branching at 1 foot + 10% pruning followed by four stem branching at 1 foot + 20% pruning compared to minimum in 2.22 m<sup>3</sup>, 30 & 11.93 kg/plant, respectively. Further, fruit weight was ranged from minimum 210.03 g in control without any training and pruning to maximum 255.53 g in four stem branching at 1 foot + 20% pruning.

In pomegranate flower regulation studies, maximum number of fruits (58.23), fruit diameter (7.50 cm), fruit weight (257.41 g) and yield per plant (14.99 kg) were recorded in *mrig bahar* as compared to minimum in control (25.67, 7.25 cm, 180.97 g & 4.65 kg, respectively). Fruit quality

attributes (TSS, acidity, maturity index) were observed better in *hasta bahar*. TSS was ranged from 16.45 to 18.50°Brix and acidity from 0.41 to 0.53 %. Fruit cracking was observed minimum in *ambe bahar* (8.50%) followed by late *ambe bahar* (9.33%) while maximum in control (22.50%) followed by *ambe + mrig + hasta bahar* (20.64 %).

In date palm, a field trial was conducted on male palm varieties (Ghanami, Al-In City, IC No. 0632315 and 624490) as a tester and four female lines (Halawy, Khalas, Barhee and Medjool) to study the effect of pollen sources, pollen storability on fruit quality. Pollen sources (IC-624490 & Ghanami) significantly affected physical & parameters of fruits *i.e.* fruit weight, length & width, pulp weight and TSS of each variety. In date palm pollen storability studies the pollen stored under refrigerator condition and defreeze can be used up to 12 months for pollination with fruit set 65-80 % and fresh pollen fruit set 89-91% but lowest 45-55% fruit set was recorded pollen stored at normal temperature.

In standardization of bunch covering material in date palm, five covering materials *i.e.*, iron wire mesh, non-woven cloth, alkathene sheet, agro-shed net and silpaulin sheet with one unbagged treatment. The yield of fruits was increased by different fruit bunch covers and maximum yield (4.95 kg/bunch and 45.55 kg/palm) was recorded in alkathene sheet followed by non woven cloth. The quality attributes *viz.*, fruit weight (7.18 g), fruit length (5.42 cm), fruit diameter (2.80 cm), volume (7.25 cc) and pulp weight (5.44 g) were recorded highest in fruits covered by alkathene sheet and non woven cloth materials.

In management of fruit drops and sun scald in bael, among the different treatments combinations, the minimum fruit drop (94.17%) and sun scald (18.00%) were recorded with grass mulch + NAA (15ppm) + coarse cotton cloth followed by grass mulch + NAA (15ppm) + ascorbic acid (95.12 and 24.10 %), respectively. The fruit drop and sunscald affected fruits were recorded maximum in control (98.00% and 47.01%). Qualitative attributes in terms of TSS (38.50°Brix), total sugar (17.12%) and ascorbic acid (21.14 mg/100g) were recorded maximum in grass mulch + NAA 15 ppm + coarse cotton cloth and these parameters was recorded minimum in control.

In canopy management studies in bael cv. Goma Yashi under rainfed semi-arid conditions, the maximum number of shoots (4.45) were recorded with 3 m plant height + 25 per cent AGE. The yield was recorded highest with 3 m plant height + 25% AGE (80.10 kg/plant) followed by 2.5 m plant height +25% AGE (73.00 kg/plant), whereas the lowest was observed with 2.5 m height +75 % AGE (59.00 kg/plant). Fruit weight (1.37 kg), fruit size (15.28 x 13.52 cm) and TSS (38.00°Brix) was recorded maximum in the plants in which height

was maintained at 3 m and pruned at 25 % annual growth extension (AGE).

In standardisation of seed germination method in drumstick cv. Thar Harsha, the seed without wing kept in between paper (rolled towel method-BP) produce healthy and vigorous seedling with highest germination (66%) followed by seed with wing-BP (48 %) while, the lowest germination (22 %) was found in seed without wing-TP followed by seed with wing-TP (42 %) with poor seedling growth.

In protected cultivation studies of muskmelon, eleven genotypes were evaluated under two set of production environment (tunnel sowing on 07.01.2022 and open condition sowing on 16.02.2022). It was found that the crop raised under tunnel was ready for first marketable fruit harvest during first week of April, whereas the crop raised under open field attained harvestable maturity during third-fourth week of April. Based on evaluation of germplasm under both the environment, the germplasm *viz.* CIAH-1, AHMM-26, AHMM-46, CHES-238 and AHMM-20 were found early maturing and promising for fruit quality attributes which were advanced for further evaluation.

### Integrated Water and Nutrient Management

Different salinity level of irrigation water with organic and inorganic fertilizers significantly effected the crop growth, yield and fruit quality. In ridge gourd cv. Thar Karni, IW 0.5 ECdSm<sup>-1</sup> + 50% organic + 50% inorganic treatments gave the significantly higher growth and yield of ridge gourd in *kharif* season crop. In radish, IW 4EC + 100% NPK+FYM was good for vegetative growth and yield whereas, roots quality parameters found better in treatment of IW 0.5EC+ 100 % NPK+FYM for radish crop. In snapmelon, IW 4 EC + FYM 15 t/ha was good for yield as well as yield response of under arid region. In kachri, combination of FYM and vermicopost with 4 EC saline water was good treatment for kachri crop for higher fruit yield. However, fruit quality registered better with the treatment of IW 0.5 EC+FYM 15 t/ha.

In nutrient management in chironji, supplementation of plant nutrients in form of inorganic and organic along with bio fertilizers gave better growth and development of the respective crops. Maximum height (537 cm), spread (NS 465 & EW 476 cm), girth (67 cm) and yield (10.5 kg/tree) were observed in the treatment applied with NPK 150 ppm and in that 50% N was applied in organic form along with bio fertilizers. In nutrient management in jamun, maximum height (416 cm), spread (NS 430 cm & EW 442 cm), girth (55 cm) were observed in the treatment applied with NPK 150 ppm and in that 50% N was applied in organic form along with bio fertilizers. In tamarind nutrient management, maximum height (630 cm), spread

(NS- 714 cm & EW 850 cm), girth (75.5 cm) and yield (12.5 kg/tree) were observed in the treatment applied with NPK 150 ppm and in that 50% N was applied in organic form along with bio fertilizers.

In bael mulching and intergrated nutrient studies, plant height (4.75m) was recorded maximum in standard dose of NPK followed by grass mulch + FYM + neem cake + 50% recommended dose of NPK + *Azotobactor* + VAM culture and it was recorded minimum in FYM 20 kg/plant, whereas plant spread (4.27m), stem girth (31.60 cm) and fruit retention (24.75 fruits/plant) was also recorded the maximum with grass mulch + FYM + neem cake + 50% recommended dose of NPK + *Azotobactor* + VAM culture under rainfed semi-arid conditions. Fruit retention was recorded minimum in control (13.17 fruits/plant). Results of study revealed non significant differences for fruit weight and size, but exhibited significant variation in quality attributes.

### Plant Protection

A survey of pomegranate growing areas of Bikaner district was conducted for occurrence of nematode. The nematode incidence was ranged from 1.33 to 12.67% with symptoms no flowering and little leaf symptom on infected plants. Further, root system is manifested by retarded growth and falling of mature plants. No root knot nematode infection was found in case of tissue culture plants.

In screening of date palm germplasm for tolerance against *Alternaria* leaf spot, forty two date palm germplasm were screened. Symptoms were observed as small light, circular and dark gray to black spots. Later on, these spots were increased in size and become irregular and black to straw colored and coalesced. Disease incidence (PDI) was found from 0.0-30.68%. Minimum disease incidence (0.0-2.52%) was recorded in date palm variety Braim, Samran, Hatemi, Saidy and Javantri while maximum disease incidence (6.43-30.68%) was found in date palm variety 'Medzool' under field conditions.

In development of a bio-fertilizer cum bio-pesticide formulation, two isolates of endophytes were isolated from the native soil and evaluated for the growth and other biochemical parameters. The rhizospheric phytopathogenic fungus from *viz.* water melon, cluster bean, cowpea and from the phyllosphere of date palm and water melon, the associated fungus has been isolated. In disease survey under hot arid ecosystem, diverse array of virus and virus like symptoms were observed on cucurbits and solanaceous crops. The symptoms included yellowing, mosaic type, growth stunting, necrosis, etc.

### Post-harvest Management and Value addition

In shelf life studies of ber genotypes, twenty seven germplasm were evaluated for shelf life at

ambient storage condition. Among the germplasm physiological loss in fruit weight was recorded maximum in Thai (14.19 & 47.52 %) and minimum in Tikadi (0.42 & 15%) during 5<sup>th</sup> and 10<sup>th</sup> day of storage, respectively. As far as dry matter content germplasm, Goma Kirti, Umran and Chuhhara recorded more than 33% dry matter and lowest dry matter recorded in Thai (11.10%). Dried fruits of ber germplasm retained colour shades from purple group (N77) to grey purple (N187).

ICAR-CIAH, Bikaner designed and fabricated two low cost drying structures (tunnel type & vertical dryer) which are more efficient, hygienic and keep the produce safe from damage by insects, rodents and other animals. The tunnel type portable dryers are of two capacities *viz.*, 5 kg (CIAH DS 1) and 25 (CIAH DS 2) kg. The CIAH DS 1 is suitable for domestic use in urban areas. The CIAH DS 2 is suitable for commercial use for drying of arid fruits and vegetables. This drying structure can be replicated at farmer's field for on-farm drying and also dimensions can be modified for making larger structure according to the need of farmer. Vertical drying structures are five storey structures and can accommodate 5 trays. Drying structure is covered by insect proof net to protect produce from insects, rodents and birds. This structure is naturally ventilated and there is no requirement for external energy to make uninterrupted air movement.

Khejri tender pods of specific maturity stage are required for getting good quality dehydrated sangri. Therefore, to identify ideal harvesting stage, maturity indices were standardized for Thar Shobha Khejri. Pods were harvested at 3 days interval *i.e.* 10, 13, 16, 19 and 22 days after setting, blanched, dehydrated and cooking parameters along with sensory attributes were studied and standardized that 1-2.5 mm pod thickness and deep green to green colour and 10 to 16 days taken after pod setting are found reliable maturity indices for sangri harvesting in Thar Shobha Khejri.

In protocol standardization for pulp extraction and preservation of snap melon, fruits were harvested at fully mature stage. A thin layer of peel is removed and fruits are cut in four vertical slices. The seeds and placenta were removed from slices. Slices are cooked in boiling water for 30-35 minutes. Cooked slices are removed and kept for cooling. After that, pulping is done by passing of slices through pulper or in mixer grinder. After pulping, pulp is sterilized at 95°C for 5 minutes, and then kept for cooling. Preservative is added after cooling and pulp is filled in air tight food grade containers for long term storage. The stored pulp can be used for preparation of various value added products like chatney, jam and ketchup.

### Technological Impact Assessment

During the reported period of time,



the preliminary information including secondary data/information about the adoption, area and production under date palm and pomegranate different districts of Rajasthan were collected. The area under date palm is highest in Bikaner district (340 ha) followed by Jaisalmer (215 ha), Sri Ganganagar (193 ha), Barmer (161 ha) and Hanumangarh (147 ha) district. The area and production under date palm was found lowest in Sikar and Jhunjhunu district of hot arid region of Rajasthan. In date palm, cost of cultivation was ranged from Rs. 1.4 to 2.37 lakhs/ha and total yield

ranged from 5.7 to 7.5 t/ha (10-12 years old orchards) while selling price of quality fresh date fruits fluctuated between 35- 60/kg.

The area under pomegranate was observed highest in Barmer district (7810 ha) followed by Jalore (3190 ha), Bikaner (1626 ha), Jodhpur (390 ha), Jaisalmer (472 ha) and Pali (301). In pomegranate, cost of cultivation was ranged from Rs. 1.36 -1.85 lakhs/ha (up to fruiting) and total yield ranged from 3.3-7.2 t/ha (4-8 years old orchards). Selling price of quality fresh fruits of pomegranate fluctuated between 40-72/kg.

## 2. INTRODUCTION

The SWOT analysis of hot arid eco-system reveals that it has ample strengths such as plenty of sunshine, vast land, human labour, bio-diversity harbouring important genes, low humidity and low incidences of insect-pests and diseases for the production of quality fruits and vegetables. In addition to this, the arid eco-system also has opportunities to improve the horticultural scenario which can lead to overall development of socio-economic and nutritional security of the inhabitants. This can be achieved if adequate technologies are made available for sustainable agricultural production in the arid and semi-arid regions.

In view of this, the National Research Centre for Arid Horticulture came into existence on 1st April 1993. This was later upgraded to Central Institute for Arid Horticulture on 27 September 2000 and CHES, Vejalpur, Godhra (earlier Regional Station of IIHR, Bengaluru) was merged as its Regional Station on 01 October, 2000. The Krishi Vigyan Kendra of Panchmahal was also established on 01 October 2005 by the ICAR under the administrative control of ICAR-Central Institute for Arid Horticulture, Bikaner. This KVK is located at Vejalpur, Godhra Vadodara Highway away about 16 km from the District Headquarter Panchmahal (Godhra).

### Mandate

- Basic, strategic and applied research to enhance sustainable productivity, quality and utilization of horticultural crops of arid and semi-arid regions.
- Repository of genetic resources and scientific information on horticultural crops of arid and semi arid region.
- Transfer of technology, capacity building and impact assessment of technologies.
- Coordinate research and validation of technologies on fruit crops of arid and semi-arid regions.

### Programmes and objectives

- To introduce, collect, characterize, conserve and evaluate the biodiversity of horticultural crops

under arid and semi-arid environment.

- To utilize the available bio-diversity and improve the target fruits such as ber, pomegranate, aonla, date palm, bael, jamun sapota, custard apple, tamarind, fig, cucurbitaceous, leguminous and solanaceous vegetable crop-plants to develop high quality and productive types having tolerance to biotic and abiotic stresses.
- To study the factors related to rapid multiplication of propagules in case of established as well as new crops and the problems related to their growth and fruit development.
- To standardize agro-techniques with respect to efficient use of soil, water and nutrients for increased horticultural productivity involving water harvesting and conservation techniques under rainfed conditions, efficient use of the scarce irrigation water and nutrient management.
- To study the eco-physiological parameters of cropping system models for utilization of high temperature and radiation resources.
- To develop post harvest technology package for extended use of the horticultural produce of arid region.
- To develop integrated pest and disease management technologies for horticultural crops under arid environment.
- To transfer the innovative technologies generated on the above aspects to farmer's field for effective horticultural development and socio-economic upliftment of the farmers
- To carry out the impact assessment of the technologies and constraint analysis.
- To serve as a repository of information related to arid and semi-arid horticulture.
- To collaborate with relevant national and international agencies for achieving the above.

Keeping in view the above mandate and objectives, the research and extension works were carried out during January-December, 2022 and the significant results obtained in different projects are presented hereunder.

### 3. RESEARCH ACHIEVEMENTS

#### GENETIC RESOURCE MANAGEMENT

ICAR- Central Institute for Arid Horticulture is premier research organization and primarily working on arid and semi-arid fruits and vegetable crops. Total germplasm conservation 1784 in fruit crops, out of which at main centre 857 of 22 different fruit crops and at regional centre 927 of 25 fruit crops under field repository. Similarly in vegetable crops, institute is working more than 25 different arid vegetable crops-plant groups and maintaining 625 germplasm at main centre and 484 germplasm at regional centre mainly focusing on desert (arid) and tribal (semi-arid) ecology. During reporting period, diverse and trait specific germplasm of arid fruits (28) and vegetables (32) were collected for further

evaluation and utilization in crop improvement programme.

#### 3.1. Improvement in Fruit Crops

##### 3.1.1 Survey, Collection and Maintenance

➤ *Ber* (*Zizyphus* sp.): During the local survey eight accession of *Zizyphus rotundifolia* (bordi) were collected at farmer's field from Udairamsar (27°93 N & 73°28 E), Rasisar (27°74 N & 73°37 E) and Napasar (27°97 N & 73°49 E) area of Bikaner district. Average height of tree ranged from 4.6 m to 14.0 m, stem circumference 10.5 to 18.0 cm and spread 3.2 -9.1 m (ES) & 3.5-8.2 m (NS). Onsite data of mother trees were recorded and budding was attempted in institute nursery to raise grafted plants (table 1 & fig 1).

Table 1. Fruit characteristics of mother tree

Accessions*	Fruit weight (g)	Fruit diameter (mm)		TSS (°B)	Traits
		Equatorial	Polar		
CIAH BU-1	7.42	24.70	22.30	10.7	Large fruit
CIAH BU-2	3.94	21.00	18.40	8.3	Suitable for drying
CIAH BR-1	3.11	22.00	17.45	6.4	Sweet oblong fruits
CIAH BR-2	3.25	17.00	18.60	7.1	Suitable for drying
CIAH BR-3	4.27	18.40	20.50	7.4	Suitable for drying
CIAH BR-4	4.54	19.00	20.10	6.9	Heavy bearer
CIAH BN-1	5.21	21.75	20.85	6.4	Very heavy bearer
CIAH BN-2	3.70	19.10	18.00	5.6	Thornless proleptic and sylleptic shoots.

\*Accession of ber from Udairamsar (U), Rasisar (R) and Napasar (N)



Fig. 1. Variability collected in *Z. rotundifolia* (bordi)

- **Date palm (*Phoenix dactylifera*):** Fourteen promising fruit samples were collected from Kutch region of Gujarat. Fresh fruit samples were analysed for different fruit characters i.e., size (3.36 to 5.31 cm length & 2.27 to 3.24 cm width), weight (8.50 to 30.0 g), stone weight (1.02 to 2.08 cm) and TSS content (22 to 35°B).
- **Ker (*Capparis decidua*):** One elite germplasm 'AHCD/KK-19' was collected from Sikar, Rajasthan and conserved in the field repository for further evaluation.
- **Lasoda (*Cordia myxa*):** One elite germplasm 'AHCM/KK 22' identified and conserved in field repository for further evaluation.
- **Pilu (*Salvadora sp.*):** Eight promising genotypes were identified from Oran land, farmer's fields and sand dunes in the Devikot, Nedan, Madasar, Sankara, Roopsi, and Chhatrail areas of the Jaisalmer district.
- **Guava (*Psidium guajava*):** Two red fleshed and one white fleshed guava genotypes were collected from Dang and Bharadia, Bharuch districts of Gujarat. Further, seventy guava accessions are being conserved in the field gene bank. Further, 25 promising hybrid selections from different cross combinations were used for *in-situ* patch budding (on 130 plants) in the months of November-December along with checks for evaluation.
- **Acid lime (*Citrus aurantifolia*):** Two genotypes of acid lime were collected from Dang and Bharuch district of Gujarat. Further, 34 acid lime accessions are being conserved in the field gene bank.
- **Karonda (*Carissa congesta*):** Two elite accessions from Ayodhya (UP) and Vejalpur (Gujarat) were collected and established in the underutilized fruit block for further evaluation.
- **Other minor fruits:** Surveyed and collected the germplasm of jamun (02), phalsa (01), manila tamarind (02) and seeds of tendu from Panchmahal, Dang and Bharuch districts of Gujarat.

### 3.1.2 Evaluation of germplasm

#### ➤ **Ber (*Zizyphus sp.*)**

Evaluation of 85 germplasm of ber for tree growth habit, fruit maturity and quality attributes under hot arid ecosystem. Among the germplasm spreading and erect growth habits were exhibited by Gola and Tikadi respectively. Early maturity of fruit was noted in Gola, Kala Gola, Ladoo whereas, late maturity was observed in Umran. Fruit weights of Narma (20g), Sanaur (19.40 g), Gola (19.17 g) were higher than that of Tikadi (2.37g). Total soluble solids(TSS) content recorded in Chhuhara (22.6°brix) and Reshmi (21.4° brix) was higher than that usually found in Gola.

### Germplasm utilization (hybridization)

**Crossability /Intraspecific hybridization:** Cross combinations (360) were attempted with different cultivars of *Zizyphus mauritiana* i.e. Gola x Reshmi, Seb x Reshmi, Gola x kathaphal, Gola x Reshmi, Gola x Mehrun, Gola x Tikadi and Tikadi x Gola. Among these combinations, only Gola x Reshmi (% fruit set) and Gola x Mehrun show maximum crossability followed by Gola x Kathaphal, but there was no fruit set in cross combinations viz. Seb x Reshmi, Gola x Tikadi and Tikadi x Gola.

Crosses between Thai and other ber varieties were attempted with the objective to improve the quality traits of fruit with donor parents viz Reshmi for TSS, Kathaphal for fruit shape and colour. A total of 764 crosses were attempted of which only 26 (3.4%) were successful. Fruits were retained till maturity only in three cross combinations viz. Thai ♀ x Reshmi♂, Thai ♀ x Kathaphal♂ and Selfing of Thai.

**Interspecific hybridization:** During the reporting period, total 120 crosses were attempted between *Zizyphus mauritiana* cultivar i.e. Gola and Seb with *Zizyphus nummularia* (used as a donor parent) to develop genetic material for specific traits i.e. early maturity, frost and drought tolerance in the hyper arid condition. Fruit set to an extent of 6% in the combination Gola (*Z. mauritiana*) x *Z. nummularia* but there was no fruit set in the cross combination Seb (*Z. mauritiana*) x *Zizyphus nummularia*.

#### ➤ **Pomegranate (*Punica granatum*)**

Evaluation of seventy pomegranate germplasm revealed significant genotypic variation in growth, fruit quality and aril attributes during *mrig bahar* under hot arid condition. Germplasm Uthkal and Yercaud were more vigorous canopy growth relative to other genotypes. The number of fruits per plant was significantly high in Bhagwa (50.35) followed by Saharanpur (49.10), Jalore Seedless (48.50), Jalore Red (42.50), Jodhpur Red (41.25) and Mridula (40.10). compared to other genotypes. Significantly less number of cracked fruits per plant was observed in sour type deciduous germplasm like Gul-e-Shah Rose Pink (1.00), Gul-e-Shah Red (1.00), Gul-e-Shah (2.00) and Sur Sukker (2.00). However, fruit weight of Jalore Seedless (285.06 g), G-137 (269.62 g) and Jodhpur collection (260.19 g) was higher than that of Yercaud Local (96.19 g) and MR 599 (101.59 g). Rind colour was varied from light green, yellowish green, light yellow, yellow, light red to red among different germplasm (fig. 2).

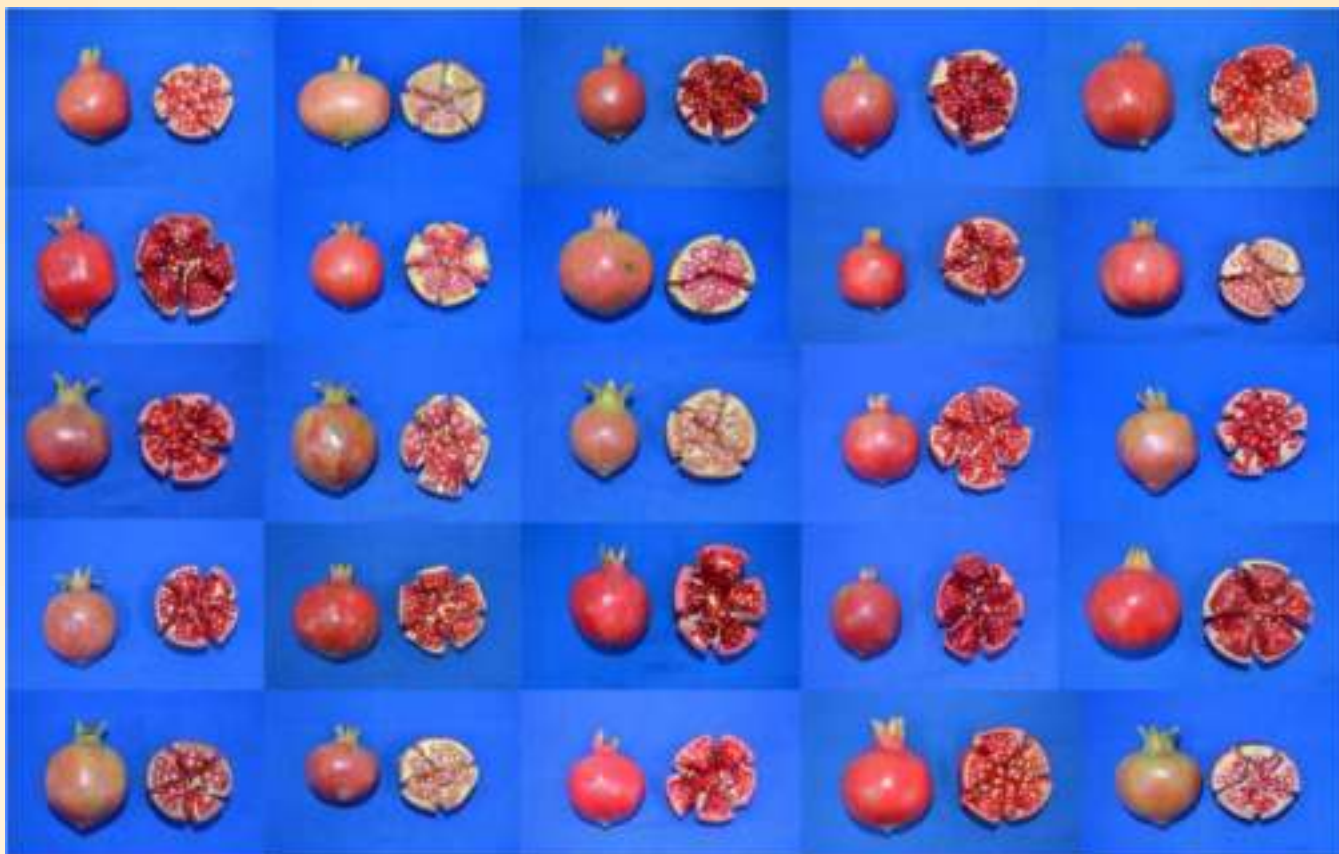


Fig. 2. Variability in fruit size, shape, aril and rind colour

Mature fruits harvested during November-December were analyzed for different bio-chemical quality attributes. The values for total soluble solids was significantly high in Saih Sirin (18.02°Brix) followed by Jalore Seedless (17.12°Brix), G-137 (17.02°Brix), Mridula (16.75°Brix), Ganesh (16.25°Brix) and Bhagwa (16.20°Brix) compared to Basein Seedling (11.02°Brix). The juice acidity recorded in Jalore Seedless (0.42%) was significantly lesser than in Tujetis EC 4347 (4.10%). The rind and aril colour was darker during *mrig bahar*, than that observed during *ambe* and *hasta bahar* fruiting, while incidence of fruit cracking was significantly less during *ambe bahar*. Due to arid environmental challenges there was poor plant growth, twig drying, defoliation, sun scald, fruit cracking and severe frost damage during winter.

#### Evaluation of promising genotypes

□ **CIAH PG-1 (IC-633374):** Plants are vigorous in nature, evergreen and semi spreading type. It has fruit weight 250 g, aril weight 35.50 g/100 arils, acidity 3.6%, TSS 14.36°Brix and fruit yield 20.67 kg/plant. It found highly suitable for anardana purpose due to high acidity of juice with high anardana recovery (fig. 3.).



Fig. 3. CIAH PG-1

□ **CIAH PG-2:** Plants are dwarf in nature, semi spreading, evergreen type growth habit and fruits red in colour. It has fruit weight 235.12 g, aril weight 27.50g/100 arils, TSS 16.05°Brix and juice 44.37%. Fruits are round in shape, dark reddish rind colour and dark pink aril colour and fruit yield 15.50 kg/plant. It found highly suitable for table purpose (fig. 4.)



Fig. 4. CIAH PG-4

- **CIAH PG-3 (IC-633375):** Plants are semi-vigorous in nature, semi spreading, evergreen type growth habit. It has fruit weight 250-260 g, arils colour light pink, seed hard and very attractive crown at harvest and can be used as breeding material.
- **CIAH PG-4 (IC-633376):** Plants are

vigorous in nature, semi spreading, deciduous type growth habit. It has fruit weight 90-120 g, fruit colour dark purple (rich in anthocyanin 202.72 mg/g), arils colour light purple and slightly sweet and hard arils. Leaves mid rib have purple coloration which gradually increases during maturity (fig. 5).



Fig. 5. CIAH PG-4 (fruits, arils and leaves)

- **CIAH PG-5 (IC-633377):** Plants are semi-vigorous, evergreen growth habit, very less or no spines (1-2/m of length) produce very less suckers (2-3/plant) and having no fruit setting.

Mridula as compared to minimum in Jalore Seedless. Aril colour was varied from light pink in Jalore seedless and Ganesh to blood red in CIAH PG-1 and Mridula while it is light purple in CIAH PG-4. The aril juice anthocyanin content was found maximum in Mridula followed by CIAH PG-1 as compared to minimum in Ganesh. CIAH PG-1 recorded boldest aril with maximum 100 aril weight 35.50g, while it was minimum in CIAH PG-4. TSS was minimum in CIAH PG-4 and maximum in Jalore Seedless. Acidity was recorded minimum in Jalore Seedless and maximum in CIAH PG-1 (table 2).

**Evaluation of genotype/lines**

Six pomegranate genotypes/ line varieties were evaluated for rind and aril quality attributes. The rind colour observed light red in CIAH PG 1, purple in CIAH PG 4, red in Bhagwa, dark red in Mridula while Yellow with red tinge in both Jalore Seedless and Ganesh. The rind anthocyanin content was found maximum in CIAH PG-4 followed by

Table 2. Evaluation of pomegranate germplasm lines for rind and aril quality attributes

Genotypes /variety	Anthocyanin (mg/kg)		100 Aril weight (g)	TSS (°Brix)	Acidity (%)
	Rind	Juice			
CIAH PG-1	187.02	277.61	35.50	14.36	3.60
CIAH PG-4	901.73	189.53	25.10	13.30	0.85
Bhagwa	133.59	227.10	31.09	16.20	0.58
Mridula	500.96	293.06	28.30	16.75	0.52
Jalore Seedless	37.57	73.47	33.65	17.12	0.42
Ganesh	60.95	51.59	30.18	16.25	0.57
CD at 5%	38.01	13.41	1.73	0.64	0.17

**Germplasm utilization (hybridization)**

During 2022-23 a total of 154 crosses were attempted including Jalore seedless, Bhagwa, Mridula and Ruby pomegranate cultivars and selection CIAH PG-4 and AHPG C-1 during *hastabahar-2022* to develop the hybrid with fruit cracking and quality improvement of pomegranate under hot arid region. All the pomegranate cultivars

in which hybridization was done were found to be cross compatible (fig. 6). Fruit set in different cross combinations ranged from 7.14 % to 28.57 %. Maximum fruit set was recorded in cross G-137 × Gul-e-shah Red (28.57%) while minimum fruit set was recorded in cross Jalore seedless × CIAH PG-4 (7.14%).



Fig. 6. Emasculated flower buds , fruit set after pollination and plants after pollination

**Development and maintenance of hybrid seedling from selected parents:**

Crossed fruit during 2021-22 were harvested at their maturity and seed were separated from the fruit and sown for development of progeny. A total of 52 (nos.) progeny plants were obtained from different cross combination. They are maintained under controlled condition and ready to transplant in the field for further evolution purpose.

➤ **Date palm (*Phoenix dactylifera*)**

Sixty four germplasm were maintained in field repository and elite four male and thirty eight female genotypes were evaluated during the period.

The elite four male date palm (IC No. 0632315, IC No. 624490, CIAH/DP/M-04 & CIAH/DP/M-05) were evaluated and for higher pollen production and recorded highest pollen grain i.e., 730.86 g per plant from CIAH/DP/M-1(IC No. 0632315) under hot arid climatic conditions.



Thirty eight female germplasm of date palm were evaluated for morphological, fruiting, yield and quality attributes. Leaf length was recorded maximum in Sabiah (353 cm) minimum in Hilali (160 cm) germplasm. Bunch length (39 cm)

and weight (8.2 kg) was highest in Hayani germplasm. Yield per palm was registered highest in Zahidi (86.6 kg) and lowest in Sakloti (8.10 kg). Fruit weight and width were recorded maximum in Medjool (17.0 g & 2.60 cm) and minimum in Tayer

(3.3 g & 1.50 cm) germplasm, respectively. Fruit quality parameters viz., pulp weight, pulp: stone and TSS content were maximum in Medjool (16g, 11.8 & 52.6 °B) and in same tune minimum in Dayari (1.8 g & 0.8) and Zaglool(19.6 °B), respectively.

(last week of June) & highly suitable for soft date (Pind Khajoor) preparation. The average yield of plant was 40-50 kg, fruit weight 11.5g, fruit size 45.7mm x 20.5mm, number of bunches per plant 10.3, stalk length 56.1 cm, bunch length 16.67 cm, number of strands 51.7, pulp stone ratio (5.6) and TSS 50.2° Brix were recorded(fig 7).

**Performance of date palm genotype**

**Dhamas:** This genotype is early maturing group



Fig. 7. Data palm cv. Dhamas fruit bearing tree, soft dates and doka stage fruits

**CIAH/DP/F2:** It is an early to mid-season (second week of July) ripening genotype which possessed crunchy in taste and suitable for fresh consumption at doka stage. The identified genotype has recorded 11.0 number of total bunches per plant and weight 6.50 kg of each. Fruit weight 7.50 g each with mean length 32.5 mm and width 21.5 mm. Yield per palm 75 kg and TSS 26.8° Brix at doka stage(fig. 8).

ripens in the last week of August to first week of September. The bunch length of 70-90cm, bunch weight 6-8 k, berries/strand 25-29, berry weight 10.11 g and size 3.15 x 2.38cm



Fig. 8. Bearing palm CIAH/DP/F2 and harvested berries at doka stage



CIAH/DP/F1



CIAH/DP/F3

**CIAH/DP/F1 and CIAH/DP/F3 genotypes:**

Two late maturing and rain tolerant genotypes of red colour berry were identified as CIAH/DP/F1 and CIAH/DP/F3, suitable for fresh consumption and preparation of processed products. Former one genotype fruits were harvested at doka stage at the end of August with bunch length of 70-90cm, bunch weight 6.50 kg, berries/strand 14.20, berry weight 7.5 g and size 3.25 x 2.15cm. Further, CIAH/DP/F3 genotype

□ **Aonla (*Emblica officinalis*)**

Field repository of aonla was evaluated for flowering, fruiting, yield attributes and fruit quality parameters at Central Horticultural experimental station under semi arid climatic condition (table 3 and fig. 9).



Table 3. Evaluation of aonla cultivars.

Inflorescence	Deep pink	Banarsi, BR-1 BR-2, Krishna
	Yellowish green	Chakaiya, , Goma Aishwarya and Kanchan
	Green to light pink	NA-7, NA-10 and Anand-1
	Light green to pinkish	Anand-2
Fruit shape	triangular	Banarasi and Krishna
	flattened round	Francis, NA-7, Goma Aishwarya, Chakaiya, Kanchan and NA-10
	flattened oval	Anand-1, BSR-1, BSR-2 and Anand-2
Fruit colour	whitish green	Banarasi and Kanchan
	light green	Krishna, Francis and Chakaiya
	yellowish green	NA-7, NA-10 and Anand-2
	greenish yellow	Anand-2
Fruit set	>50%	NA-7, Goma Aishwarya
	35-50	Krishna, NA-10, NA-10, and Kanchan
	<35%	Chakaiya and Banarasi
Fruit weight	>35 g	Banarasi
	25-35	NA-7, Goma Aishwarya, Kanchan
	<25 g	BSR-1
Fruit juice	>50%	NA-7, Goma Aishwarya
	40-50	Chakaiya, Anand-2
	<40%	Banarsi
Other ranges	Acidity 1.97 -2.24%, ascorbic acid 354.6 -498 mg/100g, TSS 8.7 -9.5% specific gravity 1.04-1.42	



Fig. 9. Field view of aonla block during flowering and promising varieties NA-7.

### Evaluation of genotypes

Among the 14 genotypes, plant height (4.05m) was recorded maximum in CHESA-4 followed by CHESA-7 (3.95m) and it was recorded least in CHESA-1 (3.41m) followed by CHESA-2 (3.15m) whereas yield per plant was recorded the maximum in CHESA-4 (45.60kg) under rainfed semi-arid conditions. Among the genotypes, tree growth which was observed semi-spreading in CHESA-1 and CHESA-2 ; tall upright in CHESA-7 and CHESA-8; tall spreading in CHES-5 and CHESA-6, semi-drooping in CHESA-4 .

### □ Bael (*Aegle marmelos*)

Among 149 genotypes flowering and fruiting were noticed during the year 2022. Genotypes exhibited variability in terms of fruit yield/ plant (68.11-145.10 kg), fruit weight (0.61-2.54 kg), fruit length (7.5-22.30cm ), seed numbers/ fruit (61.30-259.50), seed weight (0.10-0.19g) and pulp weight (0.37-2.20 kg), and for chemical composition including TSS in pulp (33.20-41.00°Brix), TSS in mucilage (40.00-54.00°brix), acidity (0.30-0.58%), ascorbic acid (12.12-23.75 mg/100g), total phenol contents (1781-2710

mg/100g) and total sugar (14.12-19.12%) exhibited wide variation. Among the germplasm, considerable variability with regards to physical composition of fruit viz., pulp (44.30-73.17%), shell (12.90-27.21%), fibre content (2.47-6.49%), mucilage (11.07-19.40%) and seed content (1.71-5.35%) were recorded, among the studied germplasm. Genotypes showed wide variation in ripening period (February to June). Based on the observation on various aspects particularly fruiting pattern and quality attributes, genotypes, viz., CHESB-27, CHESB-29, CHESB-31, CHESB-42, CHESB-48 CHESB-59, CHESB-60, CHESB-62, CHESB-69, CHESB-71, CHESB-73, CHESB-77 and CHESB-78 were found to be superior under rainfed semi-arid ecosystem.

#### □ Wood apple (*Limonia acidissima*)

The wood apple germplasm fruit colour of genotypes was observed from dull white to grayish. In addition, the genotype CHESW-10 was noted with peculiar flat fruit shape. The fruit pulp color was noted pale gold to coffee brown. The maximum fruit weight was recorded in Thar Gaurav (445.00g) followed by Thar Prabha (388.10g) while it was minimum in CHESW-7 (165.12g). The fruit yield per plant highest yield was noted in Thar Prabha (160.0kg/plant) followed by CHESW-4 (129.27kg) Thar Gaurav (130.12kg) and CHESW-15 (121.23kg) whereas it was found minimum in CHESW-1 (61.00kg). The highest total soluble solids (TSS) was recorded in genotype Thar Prabha (19.50°brix) in fruit pulp. Among them, genotype CHESW-2, CHESW-6 and CHESW-10 were found to be promising on the basis of qualitative and yield traits.

#### Evaluation of genotype

**Thar Prabha:** Fruit weight of Thar Prabha is 380.12g having 19.80°brix TSS. The Fruit start ripening from 2nd fortnight of December and it come under late maturity group. The average fruit yield per plant was recorded 170.00 kg/plant in 15<sup>th</sup> year plant age under rainfed conditions of hot semi-arid ecosystem.



Wood apple (Thar Prabha)

**CHESW-10 :** Physio-chemical attributes of genotype CHESW-10 in respect of fruit weight, total number of seed/fruit, pulp percent and TSS were recorded as 350.20g, 516.20, 52.50% and (17.50obrix) respectively. This genotype observed with flat-round fruit shape and fruit ripening starts from 1<sup>st</sup> week of December. The fruit yield per plant was recorded 134.90 kg/plant during 14<sup>th</sup> year of planting under rainfed conditions of hot semi-arid ecosystem.



Wood apple (CHESW-10)

#### □ Custard apple (*Annona squamosa*)

The existing forty seven (47) custard apple germplasm were evaluated and recorded variation on fruit weight (122.12-335.30g), fruit length (5.40-8.19cm), fruit diameter (5.12-8.51 cm), pulp weight (49.00-245.31g), rind weight (38.20-132.00g), pulp percentage (41.23-64.51%), , fruit pulp color (creamy white to dull white), pulp texture (soft to gritty), total sugars (13.28-18.37%), reducing sugars (12.30-15.50%), ascorbic acid (17.93-42.39 mg), no. of flakes (30.87-92.70), firmness of flesh (firm to medium), T.S.S. (24.00-32.10°Brix), acidity (0.24-0.57%), shelf life (3-5 days) and yield (14.00-32.70 kg/tree). Among the evaluated existing germplasm CHESCA-13, CHESCA-23 and CHESCA-27 were found superior for fruit quality and yield characters under rainfed conditions of semi-arid ecosystem.



Field view of custard apple genotypes

**Evaluation of promising genotype**

**Thar Amrit:** It has spreading growth habit, starts flowering in 2<sup>nd</sup> year, regular bearer and ripens in 1<sup>st</sup> fortnight of November. Genotype has 320.12g average fruit weight, 63.58% fruit pulp, and 29.12° Brix T.S.S. The average fruit yield per plant was recorded 24.80kg during 11<sup>th</sup> year after planting under rain-fed conditions of semi-arid ecosystem.



➤ **Citrus sp. (Citrus spp.)**

Fifty five germplasm of different citrus species namely sweet orange, mandarin, lime etc were maintained infield repository and performance study were conducted during the

reporting period.

**Sweet orange cv. Mosambi and Sathgudi scions on different rootstocks**

The plant canopy and compatibility index of sweet orange cv. Mosambhi and Sathgudi were greatly influenced by various rootstocks under hot arid climatic conditions. Rangpur lime (162.42) and Volkamericana (163.42 cm) had the highest plant heights of Mosambhi. However, Sathgudi plants reached their greatest heights on Karna khatta rootstock (163.33 cm) followed by Rangpur lime plants (134.00 cm) and Rough lemon plants (120.40 cm), while Pectinifera plants reached their shortest heights (70.17 cm). The rootstocks Sour orange (100%) and Rough lemon (57.17%) had the highest and lowest scion survivability rates, respectively (table4).

Table. 4. Effect of rootstocks on growth and compatibility attributes

Rootstocks	Canopy spreading (cm)				SR ratio		Survibility %	
	Mosambi		Sathgudi		Mosambi	Sathgudi	Mosambi	Sathgudi
	(NS)	(EW)	(NS)	(EW)				
Pectinifera	32.5	46.01	-	-	0.99	-	42.85	-
Karna khatta	179.17	165.83	121.01	126.00	0.96	0.89	85.71	85.71
Rangpur lime	180.67	171.17	105.83	113.33	0.97	0.94	85.71	71.42
Volkamericana	183.33	189.17	123.75	137.50	0.99	0.96	85.71	85.71
Rough lemon	146.67	158.60	55.83	64.17	0.90	0.96	42.85	57.14
Cleopatra	97.50	82.50	114.16	115.5	0.77	0.77	28.57	85.71
Macrophylla	132.43	125.71	87.29	85.71	0.87	0.96	100	85.71
Sour orange	99.01	90.00	155.83	146.67	0.99	0.89	71.42	100
CD at 5%	18.85	17.89	-	-	NS	-	-	-

**Mandarin var. Fremont on four rootstocks**

A field trail was conducted on mandarin var. Fremont grafted on four rootstocks (Pectinifera, Troyer citrange, Karna Khatta and Rough Lemon) and observed the stionic ratio was greatest in the Fremont/Pectinifera, while the lowest was found in the Fremont/Troyer citrange combination. The Karna Khatta rootstock had higher fruiting density, heaviest fruits, maximum numbers of fruit and fruit yield followed by and Pectinifera rootstocks, while all these parameters were found lowest in Troyer Citrange. A positive significant correlation was found in Karna Khatta and Rough lemon for higher growth and yield attributes; fruit quality parameters in Pectinifera.

**Sweet orange varieties under hot arid region**

Ten cultivars of sweet orange (Washington Navel, Blood Red, Newhall Navel, Jaffa, Satgudi,

Hamlin, Mosambi, Pineapple, Valencia Olinda, and Lane late on rough lemon rootstock) were tested for growth, productivity, and fruit quality in Rajasthan's hot desert climate. In terms of growth and canopy features, Sathgudi, Hamlin, and Jaffa ranked highest, while Valencia Olinda and Pineapple cultivars scored lowest. Additionally, the Sathgudi cultivar generated the highest fruit production and the earliest fruit harvesting; the pineapple produced the lowest fruit yield, whereas Valencia Olinda and the pineapple produced fruits with no seed or low seed (15), high TSS, and pleasing juice flavors. Since its planting, no fruit has been produced by the Washington variety. When compared to other cultivars, the Sathgudi and Jaffa cultivars produced the most fruit over the 20192020 to 20202021. Thus, under irrigated hot arid climate of Rajasthan sweet orange cv. Satgudi was comparatively better over other cultivars.

**Acid lime (*Citrus aurantifolia*)**

Among twenty evaluated genotypes, CHESL-13 recorded the maximum plant height (3.95 m) and spread (6.30 & 5.30 m), while Ganganagar-1 was found most dwarfing (2.25 m). The maximum stem girth was recorded in CHESL-12 (18.35 cm) followed by CHESL-13 (16.50 cm) and CHESL-22 (15.60 cm). Acid lime accession CHESL-15 recorded the highest fruit weight (43.58 g) and width. A minimum peel thickness of 1.33 mm was observed in CHESL-14. However, the highest juice percentage (53.30 %) was recorded in CHESL-29 followed by CHESL-15 (51.39%) and CHESL-22 (51.38%). Pramalini (9.18 °B) recorded the maximum TSS followed by CHESL-32 (9.09° Brix), while CHESL-29 (6.97 °B) recorded the minimum TSS. The highest acidity was observed in CHESL-12 (8.45 %), while Ganganagar-1(5.42 %) recorded the minimum acidity. The highest ascorbic acid was recorded with CHESL-12 (44.15 mg/100), while Ganganagar-1(24.75 mg/100) recorded the

minimum ascorbic acid. However, the highest yield/tree was observed in CHESL-12 (49.66 kg) followed by CHESL-15 (46.18 kg), Pramalini(43.67 kg) and minimum in CHESL-13 (29.33 kg).

**Evaluation of promising genotypes**

**Thar Vaibhav:** It is a precocious and prolific bunch bearing variety of acid lime having vigorous and spreading growth habit. Fruits are round with attractive yellowish smooth peel. Fruit is juicy (49 %), acidic (6.84 %) with less number of seeds/fruit (6-8). It is high yielder with an average yield/plant is 60.15 kg during 6<sup>th</sup> year of planting under rainfed hot semi-arid conditions in western India. Its average fruit weight is 42.57 g; fruit size 42.71 mm x 42.82 mm, peel thickness 1.59 mm, TSS 7.34°Brix and ascorbic acid 43.45 mg/100 ml. Fruit ripens in 125-135 days in summer while rainy season and winter season crop may take 145-155 days from fruit set with excellent keeping quality at ambient storage.



Bearing tree



Bunch bearing



Mature fruits

**CHESL-29:** It is having tall growing and spreading canopy with less thorn density with less incidence of citrus canker. Fruits are roundish, medium size with prominent green vesicles. It is cluster bearer with average fruit weight of 42.43 g having fruit size of around 43.72 x 38.39 mm. Average yield/plant is 42.0 kg during 7<sup>th</sup> year of its age, fruit axis solid, segment 11 no., peel thickness 1.34 mm and total number of seed/fruit 5-8. Fruit juice 53.30%, TSS 6.97°Brix, acidity 6.56% and ascorbic acid 41.67 mg/100 ml. Keeping quality of fruits is good at ambient storage with attractive yellow smooth peel.

**CHESL-32:** It mostly bears inside the canopy in clusters, having spreading growth habit. It is higher yielder, having bigger fruit size with high juice content (49 %). Average yield/plant is 30 kg during 5<sup>th</sup> year of its age, fruit weight above 39 g, fruit size 42.28 mm x 41.02 mm, fruit axis solid, segment 12 no., peel thickness 1.51 mm and total number of seed/fruit 5-6. Fruit juice contains TSS 9.09°Brix,

acidity 8.18%, TSS: acidity 1.11 and ascorbic acid 30 mg/100 ml. Keeping quality of fruits is good at ambient storage (8-10 days) with attractive yellow smooth peel.

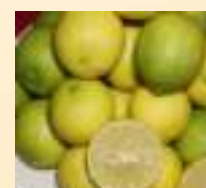
**CHESL-15:** It mostly bears inside the canopy and having spreading growth habit and fruits are almost free from citrus canker. Average yield/plant is 46.18 kg during 6<sup>th</sup> year of its age, fruit weight above 40 g, fruit size 46.37mm x 43.08 mm, fruit axis solid, segment 10 no., peel thickness 1.49 mm and total number of seed/fruit 8-9. Fruit juice 51.39%, TSS 7.86°Brix, acidity 6.87%, TSS: acidity 1.14 and ascorbic acid 38.17 mg/100 ml. Keeping quality of fruits is good at ambient storage (8-10 days) with attractive yellow smooth peel.



CHESL-29



CHESL-32



CHESL-15

➤ **Jamun (*Syzygium cumini*)**

Total germplasm maintained in the field gene bank is 72. Fifteen promising genotypes of jamun were evaluated for flowering, fruiting and fruit quality attributes. Variation was observed growth habit amongst evaluated genotypes which was found as spreading, upright, semi-spreading and upright. Maximum panicle length was recorded in CHESJ-30 (13.39 cm), closely followed by CHESJ-28 (12.17 cm) and CHESJ-34 (12.13 cm). Peak period of ripening was recorded in the month of May-June in all the genotypes evaluated with earliest harvest in CHESJ-36 in 3<sup>rd</sup> week May followed by last week of May in CHESJ-28, CHESJ-31, CHESJ-32, CHESJ-34, CHESJ-35 and CHESJ-38 while rest of genotypes got ripened in the 3<sup>rd</sup> week June.



Fruiting pattern in jamun (CHESJ-30)

As far as fruit yield regards maximum recorded in CHESJ-30 (36.36 kg/plant) followed by CHESJ-38 (34.22 kg/plant), CHESJ-32 (33.43 kg/plant) and minimum in CHESJ-34 (18.16 kg/plant). Higher fruit quality parameters were recorded in CHESJ-30 with respect to fruit weight (19.10 g), pulp (85.26 %), TSS: acid (38.37), total sugar (11.94 %) and ascorbic acid (44.03 mg/100g).

**Evaluation of varieties**

➤ **Jamun (*Syzygium cumini*)**

Among four varieties viz., Goma Priyanka, CISHJ-37, CISHJ-42 and Konkan Bahdoli, maximum plant height was recorded in CISHJ-37 (6.14 m) followed by CISHJ-42 and Goma Priyanka. Stock and scion girth was found maximum in CISH-37 closely followed by CISHJ-37. Fruit yield was found to be the maximum in Goma Priyanka followed by CISH 37. Minimum fruit yield per plant was noted in CISH 42. Maximum fruit weight, pulp content was recorded in Goma Priyanka closely followed by CISHJ-37.



Jamun variety Goma Priyanka

➤ **Guava (*Psidium guajava*)**

**Red fleshed :** Amongst evaluated accessions, CHESG-16 was found most vigorous regards to fruit number and yield observed in Hyb. 4/18 (385 & 60.06 kg/plant) and minimum number of fruits/tree was recorded in CHESG-30 (55 & 7.15 kg/plant). The maximum fruit weight was observed in H-2 (236.03 g) and minimum was recorded in Bhavnagar-2 (108.15 g). However, the maximum seed hardness was recorded in CHESG-30 (16.70 kg/cm<sup>2</sup>) followed by CHESG-24 (16.50 kg/cm<sup>2</sup>) while Hyb 4/3 recorded the minimum seeds hardness (10.32 kg/cm<sup>2</sup>).

The highest TSS was recorded in Bhavnagar-2(14.89<sup>o</sup>Brix), while the minimum in CHESG-30 (9.79<sup>o</sup>Brix). Regards to ascorbic acid observed in H-1 (278.86 mg/100 g), while Ratandeeep recorded the least (115.30 mg/100 g). The pectin content was ranged in between 0.82 % in CHESG-31 to 1.30 % in Suv Pink. Significantly the highest  $\beta$ -carotene (0.50 mg/100g FW), K (297.35 mg/100g FW) and Total antioxidant activity (549.20 AAE/100g) were recorded in H-1 while CHESG-21 recorded the maximum Lycopene (17.33 mg/100g FW), Ca (37.57 mg/100g FW). CHESG-15 recorded highest flavnoids (18.38 mg Cat. Equi./100g). However, H-2 recorded the maximum Total Phenols (496.40 GAE/100g), Hyb 4/7 recorded the maximum P (25.10 mg/100g FW) while Hyb 4/17 recorded the Mg (51.40 mg/100g FW).

**White fleshed:** Among evaluated genotypes, CHESG-24 recorded the maximum plant height (4.78 m), plant spread (5.23 x 5.05 m) and stems girth (17.30 cm). The fruit weight of white fleshed genotypes ranged between 118.35 g in MPUAT-1 and 238.50 g in CHESG-38. The maximum number of fruits/tree was observed in MPUAT-1 (215)

followed by CHESG-38 (155) while least in Dhawal (50). Highest fruit yield/tree was recorded in CHESG-38 (36.90 kg) followed by L-49 (30.50 kg) while least in Dhawal (7.15 kg)

The maximum TSS was recorded in CHESG-39 (14.35<sup>o</sup>Brix) while the least in Seedless (10.40<sup>o</sup>Brix). CHESG-4 recorded highest acidity (0.67 %) while Seedless recorded the least (0.40 %). CHESG-39 recorded maximum ascorbic acid (288.84 mg/100 g) and least in CHESG-29 (77.50 mg/100g). Dhawal recorded the highest total sugar (9.87 %) while CHESG-29 recorded the least (6.67 %). The pectin content was ranged in between 0.85 % in CHESG-1 to 1.57 in VNR Bihi 1.

### Evaluation of promising lines

**H-1(CHESG-15 x Thai):** The plants are vigorous and prolific bearer (35.50 kg/tree during 4<sup>th</sup> yr), fruits are round shape, weight ( 250-280 g) with smooth, yellowish green peel and pulp is red. It is soft seeded with 100 seed weight of 1.40 g with seed hardness of 11.15 kg/cm<sup>2</sup>. Fruit pulp is rich in  $\beta$ -carotene (0.50 mg/100g FW), lycopene (13.45 mg/100g FW), K (297.35 mg/100g FW) and Total antioxidant activity (549.20 AAE/100g).

**H-2(CHESG-15 x Thai):** This is having upright growth habit and bears in bunches (39.50 kg/tree during 4<sup>th</sup> yr), fruits are round, medium fruit weight 250-280 g with smooth, yellowish green peel and pulp is light red. It is having good blend of TSS (10.50<sup>o</sup>B) and acidity (0.36 %) and contains ascorbic acid above 200 mg/100 g pulp. It is soft seeded with 100 seed weight of 1.28 g with seed hardness of 11.33 kg/cm<sup>2</sup>.

**CHESG-38:** It has medium tree vigour and compact semi-spreading canopy. Fruits are round in shape, weight 220-240 g and average yield 37 kg/tree during 6<sup>th</sup> yr. Fruit peel is whitish yellow in colour and shelf life of fruits is good at ambient storage (5 days). It is soft seeded with 100 seed weight of 1.22 g and having seed hardness of 12.53 kg/cm<sup>2</sup>. Fruit pulp is rich in pectin (1.28%), TSS (13.65<sup>o</sup>B) and total sugars (9.58 %).

**CHESG-39:** It is having medium spreading canopy and fruits are round in shape, medium fruit weight (170-185 g) with average yield 28.55 kg/tree during 5<sup>th</sup> year. Keeping quality of fruits is good at ambient storage (4-5 days). It is soft seeded with 100 seed weight of 1.42 g and having seed hardness of 12.53 kg/cm<sup>2</sup>. Fruit pulp is rich in pectin (1.40%), TSS (14.35<sup>o</sup>B) and total sugars (9.80 %).



### Performance evaluation of promising F<sub>1</sub> hybrid /selections:

Plant growth, yield and fruit quality characteristics during 1<sup>st</sup> year of harvest of 9 promising F<sub>1</sub> hybrid /selections along with the check variety were recorded (table 5). The mean yield of new selections were high (5.07-15.39 kg/tree) in comparison to Lalit (4.15 kg/tree).

Table. 5. Growth, yield and quality characteristics of promising F<sub>1</sub> hybrid /selections.

Cross	Sel. No.	Tree height (m)	Tree spread (m)	Trunk dia. (cm)	Fruit No./tree	Yield/tree (kg)
BLxSP	H-1/17	3.36	3.25	7.17	54.33	10.74
ThaixG-30	H-2/5	3.47	3.65	7.55	28.33	8.63
Thai x SP	H-2/20	2.87	3.05	6.17	46.66	12.73
	H-A2/17	3.16	2.68	5.89	16.66	5.07
SPxG-28	H-2/28	2.56	2.40	5.32	80.0	13.55
	H-2/36	3.27	3.10	5.97	98.33	14.24
MP-2xG-15	H-4/11	4.07	3.70	8.92	42.0	8.17
G-31xTP	H-4/19	3.86	3.70	8.41	118.33	15.39
	H-15/36	2.46	2.85	7.69	76.66	15.13
	Lalit	2.77	2.90	5.68	30.0	4.15
CD (0.05)		0.003	0.53	0.98	14.98	3.26
PF-pink fleshed, OP-orange pink, LPF-light pink fleshed, RF-red fleshed, Med-medium, Obov-obovate, Ellep-elleptic						

The highest fruit number was produced by H-4/19. Variations were also observed in pulp colour, fruit shape and pulp texture. H-A2/17, H-2/20, H-2/28 and had H-2/36 crunchy pulp texture. Number of seeds/fruit which was highest in H-4/11 (404.66)

followed by Lalit and lowest in H-2/28 (212.33). TSS ranged from 13.81-9.260B, acidity from 0.28-0.53% and ascorbic acid from 103.66-189.41 mg/100g (table 6 & fig. 10).

Table. 6. Physico-chemical quality characteristics of promising F<sub>1</sub> hybrid /selections.

Cross	Sel. No.	Fruit wt. (g)	TSS (°B)	Acidity (%)	Ascorbic acid (mg/100g)
BLxSuvPink	H-1/17	202.87	12.81	0.39	145.0
Thai x CHESG-30	H-2/5	316.75	10.0	0.41	115.67
Thai x Suv Pink	H-2/20	235.13	10.46	0.32	183.33
	H-A2/17	294.48	9.80	0.34	134.0
SPxCHESG-28	H-2/28	172.40	10.66	0.45	154.99
	H-2/36	159.76	11.76	0.41	129.0
MPUAT-2 x CHESG-15	H-4/11	203.42	11.83	0.38	189.41
CHESG-31 x Taiwan Pink	H-4/19	158.13	10.36	0.40	103.66
	H-15/36	218.18	9.26	0.28	130.0
	Lalit	146.01	13.81	0.53	184.65
SEm±		15.16	0.85	0.02	4.03
CD (0.05)		43.49	2.53	0.06	11.98
CV (%)		16.14	13.36	10.33	4.75



Fig. 10. Pulp colour variation in F<sub>1</sub> hybrid selections

### Performance of F<sub>1</sub> progenies

Hybrid seedlings showed healthy and vigorous growth after establishment in the field. Among different cross combinations, VNR x CHESG-15 (2.95 m) and Thai x MPUAT-2 (2.78 m) produced the tallest canopy height and spread in comparison to other crosses while Purple-2 x Suv. Pink had comparatively shorter plant height (1.44 m) and spread (1.44 m). Most of the crosses

produced round fruit shape except Purple-2 x Suv Pink, which had obovate fruit shape. Majority of plant population had pink flesh in crosses of VNR Bihi (white fleshed) x CHESG-15 (Red fleshed) and Purple-2 (Red fleshed) x Suv. Pink (Red fleshed) while white fleshed combinations had only white fleshed fruits. Fruit weight, size, seed core diameter, pulp thickness and other fruit quality characters also varied among progenies (table 7).

Table. 7. Growth and fruit quality characters of F<sub>1</sub> hybrid seedlings

Cross/parent	Height (m)	Fruit wt (g)	100 seed wt (g)	Fruit No./tree	Yield/tree (kg)	TSS: acidity	Ascorbic acid (mg/100g)
VNRxG-15	2.68	243.79	1.13	81.20	17.63	27.83	174.28
MP1xMP2	2.64	129.78	1.50	63.0	8.51	22.60	161.00
Pur 2 x SP	2.18	208.49	1.26	32.50	7.48	19.18	200.75
ThaixMP2	2.88	250.82	1.65	51.0	12.24	25.04	285.01
Sem±	0.11	18.25	0.06	7.52	1.83	1.62	10.85
CD (0.05)	0.35	53.68	0.19	21.82	5.39	4.79	31.92
CV (%)	9.94	24.79	11.12	41.77	45.27	19.33	15.46

➤ **Tamarind (*Tamarindus indica*)**

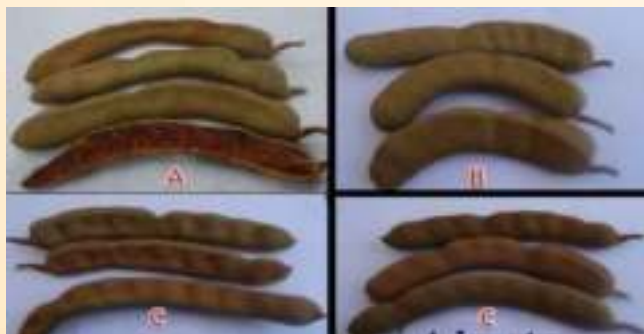
Twenty four genotypes of tamarind were evaluated for growth, flowering, fruiting and fruit quality attributes. On the basis of fruit yield and quality attributes, CHEST-10 was found promising. It has up right growth habit, thick trunk and drooping branches. It recorded 85.0-100.0 kg fruit per plant. Peak period of ripening time was last week of March. It recorded 52.20 pulp percentage and 70.30°Brix TSS at ripened stage.



Fructing in tamarind (CHES-T-10)

**Evaluation of varieties**

Ten tamarind were observed on growth pattern and fruit quality attributes were recorded. Plant height of Ajanta was observed maximum i.e. 6.35 m while least plant height was recorded in Sweet Type (4.15 m). The stock girth was found to be least (64.25 cm) in Bantoor. Plant spread (E-W and N-S) was also found maximum in Ajanta. Maximum fruit yield was noted in Goma Prareek (55.65 kg / plant). Maximum pod length (14.55 cm) and pulp content (51.78 %) was recorded in Goma Prateek, while maximum TSS (68.44°Brix) and total sugar (49.92%) were recorded in Urigum. Maximum acidity was registered in PKM-1(13.43 %) followed by T-263 (13.30%) and minimum in Sweet type (8.43%). Similarly, ascorbic acid was recorded maximum in Goma Prateek (26.50 mg/100g) and minimum in Pratisthan (13.50 mg/100g).



Tamarind varieties a. Goma Prateek B. Bantoor C. Urigam D. Ajanta

➤ **Manila tamarind (*Pithecolobium dulce*)**

Thirty germplasm have been evaluated during flowering period (January-February). Earliest flowering took place in CHESM-4, while it was noted at the last in CHESM-12. Maximum panicle length, fruit weight 30.00 g with 73.00 % pulp was recorded in CHESM-4, while, highest TSS was recorded in CHESM-12 (25.10°B).

Yield/plant is 14-17 kg during 5<sup>th</sup> year of age, fruit weight 30.70 g, fruit size 12.0 cm x 1.80 cm, pod segment 10-12 no., total number of seeds/fruit 8.7, weight of individual aril 1.60g. Fruit juice 46.50%, TSS 22.24°Brix, acidity 0.71%, ascorbic acid 63.20 mg/100 ml and total sugar 15.85%.



Mature fruit of Manila tamarind CHESM-4

‡ **Ker (*Capparis decidua*)**

Sixteen genotypes were evaluated for morphological characteristics. Genotype AHCD-3 registered maximum shrub height (4.97 m) followed by AHCD-1 (4.91 m) and minimum in AHCD-15 (2.03m). Plant spread maximum in AHCD-1(IC No.-0634593) (5.05 x 5.15m) and also thornless genotype. Maximum fruits per cluster at pea stage (4.4) were observed in genotype AHCD-1 and minimum (1.8). Marketable harvesting is observed from 9 to 11.33 days after flower bud opening and also characterized fruits in different shape (oblong to conical round), colour (scarlet, cherry to crimson red, green and violet). Fruit weight at ripe stage was varied from 1.36 g (AHCD-10) to 6.27 g (AHCD-5).

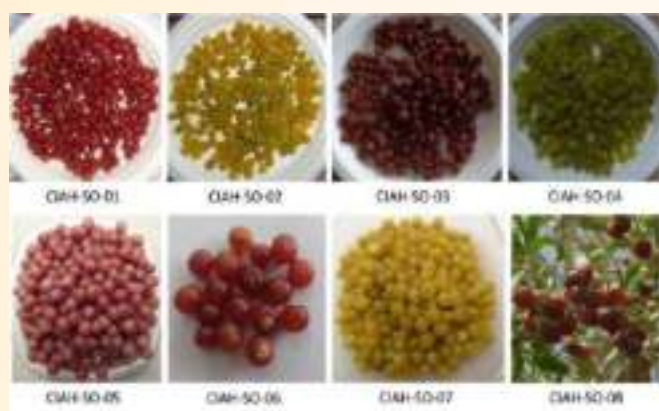


Thornless ker (AHCD-1) Different flower colours of ker genotypes Violet coloured fruiting in ker



### ➤ **Pilu (*Salvadora persica*)**

Eight promising genotypes were identified from Oran land, farmer's fields, and sand dunes in the Devikot, Nedan, Madasar, Sankara, Roopsi, and Chhatrail areas of the Jaisalmer district. The morphological traits such as tree height, spread, circumference, canopy density, leaf and fruit traits etc, were recorded. Leaves are light green to yellowish green, simple, oppositely arranged, cross venulate, linear-or lanceolate with entire leaf margin, leathery and somewhat fleshy. The identified genotypes showed significant variation in leaf blade length (4.27 to 8.58 cm), leaf blade width (0.68 to 8.58 cm), leaf thickness (0.18 to 0.44 mm),



petiole length (4.52 to 8.14 mm) and petiole diameter (0.66 to 0.94 mm). The fruit is a drupe, sub-sessile, delicate, fleshy, and transparent when mature. A high variability has been observed in the identified genotype with regard to fruit geometric mean diameter (7.66 to 9.41 mm), fruit surface area (1.79 to 2.79 cm<sup>2</sup>), fruit volume (2.26 to 4.42 cm<sup>3</sup>), fruit sphericity (88.47 to 114.64%), fruit aspect ratio (83.29 to 122.91), shape index (0.82 to 1.21), fruit weight (0.40 to 0.64 g), seed weight (0.024 to 0.056 g), fruit to seed ratio (7.70 to 12.89). Further, the identified genotypes also showed significant variation in TSS content ranging from 17.52 to 27.76 °B with an average of 21.84 °B (fig. 11).

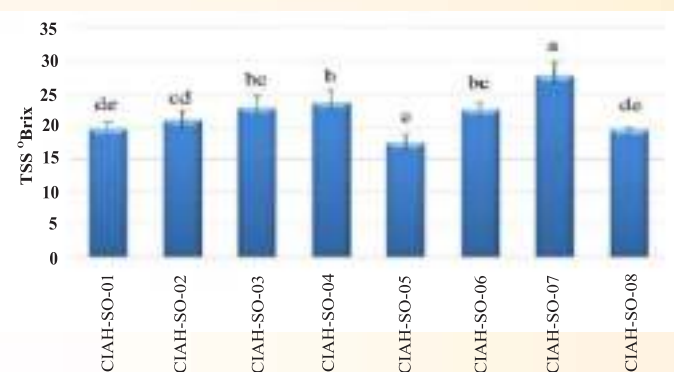


Fig. 11. Total soluble solids in fruit of identified genotypes of *Salvadora oleoides*. The bars represent  $\pm$  S.D. Values followed by the same letter are not significantly different ( $p=0.05$ ).

### ➤ **Olive (*Olea europaea*.)**

During 2022 a adaptive field trial of olive was initiative with six varieties (Arbequina, Koroneiki, Coratina, Barnea, Picholine and Frantoio). Material was procured from Centre of excellence Bassi, SIAM Durgapura, Jaipur and planted in the research farm at ICAR-CIAH, Bikaner for evaluation under hyper arid climatic condition.

#### 3.1.3 Biochemical and biotechnological studies

##### □ **Mechanism of tolerance to concurrent Abiotic stresses in Ber (*Ziziphus spp.*)**

The response mechanism of *Z. mauritiana* (susceptible) and *Z. nummularia* (tolerant) against concurrent abiotic stresses entirely different from each other. The present study was conducted to evaluate the pattern of stress responsive metabolites a significant variation among seasons as well as between species was observed in all evaluated parameters like phenols, flavonoids, TAA, prolines, tannins, MDA and antioxidant enzymes activities in both the species. The increase accumulations of stress responsive metabolites was observed in *Z. nummularia* during the sever summer (May-June)

and winter (Dec-Jan) months while in *Z. mauriana* it was decrease during these months. The catalase activity was only increased during winter months in *Z. nummularia* while in *Z. mauriatiana* it was increased during March and October months. The accumulation pattern of proline content was almost synchronous between both the species. The absolute values for phenolics, flavonoids, TAA, Tannins, APOX and SOD activities in leaves of *Z. nummularia* was significantly higher and MDA content was significantly lower than that of *Z. mauritiana* throughout the years. The extreme summer and winter conditions create sever oxidative stresses due to overproduction of ROIs and hydrogen peroxides in plant, consequently, require maximum amount of ROI scavengers to cope with the generated oxidative stress. This study demonstrated that *Z. nummularia* plant has strong Bottom-up (intrinsic) antioxidant defense mechanism which responds quickly towards occurrence of oxidative stress and produce ample amount of stress responsive metabolites and scavenge the generated ROIs, which make it tolerant against concurrent Abiotic stresses. While

the defence mechanism of *Z. mauritiana* is not strong enough to produce ample amount of stress responsive metabolites to scavenge the generated

ROIs under oxidative stress and unable to tolerate the concurrent Abiotic stress (fig. 12).

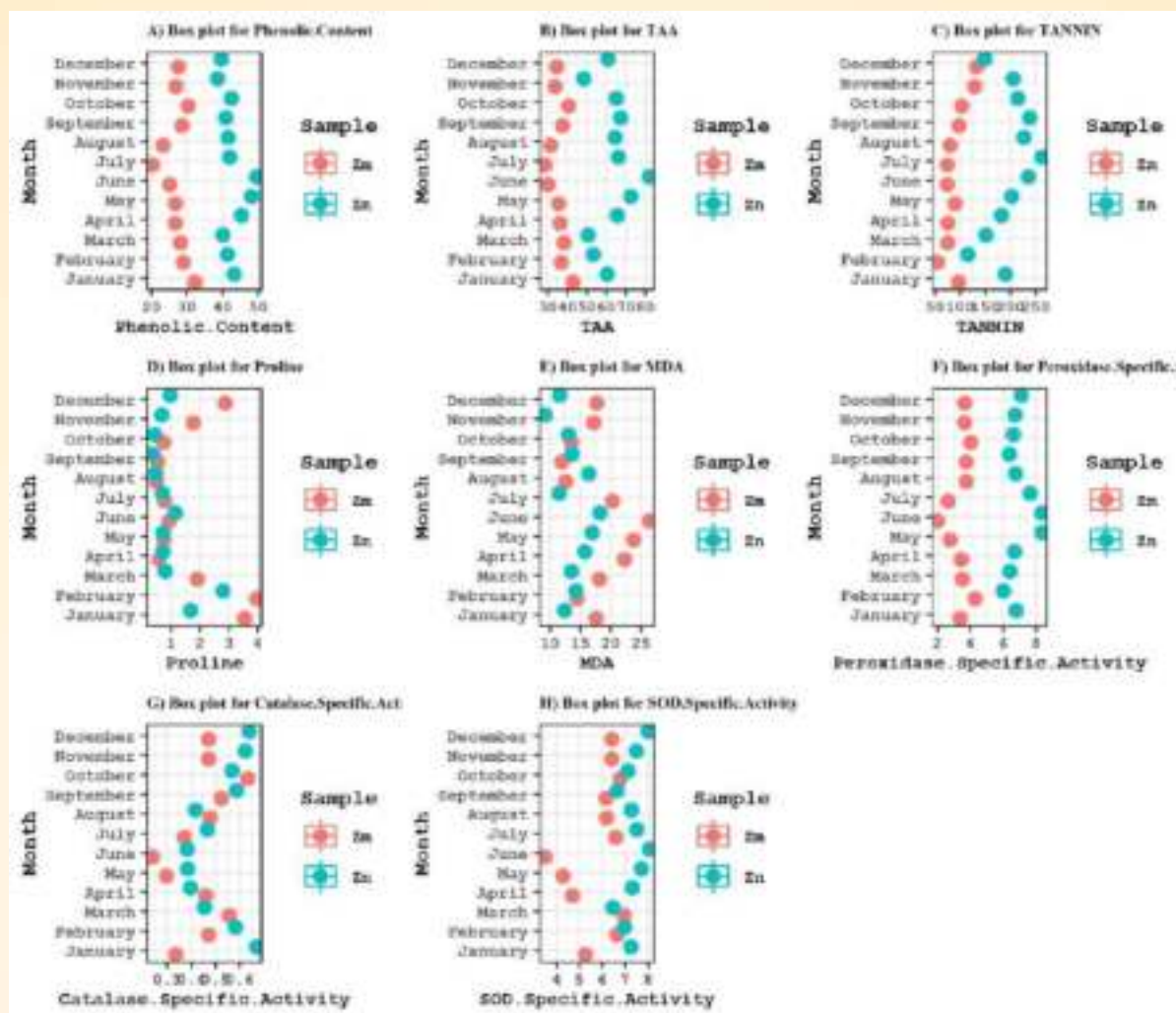


Fig 12. Seasonal variation in stress responsive metabolites accumulation in the leaves of *Zizyphus sp.*

**Molecular characterization of male date palm**

Characterize the 9 male date palm genotypes, CIAH-DP-M1 found superior in all the parameters related to the inflorescence. One hundred sixty eight alleles with moderate level of PIC value (0.29 to 0.38) were produced by 24 ScoT

markers in 9 male date genotypes. However, the resolution power of ScoT markers analysed was high. The UPGMA clustering analysis grouped 9 male date palm genotypes into two major group (fig. 13 & fig. 14).

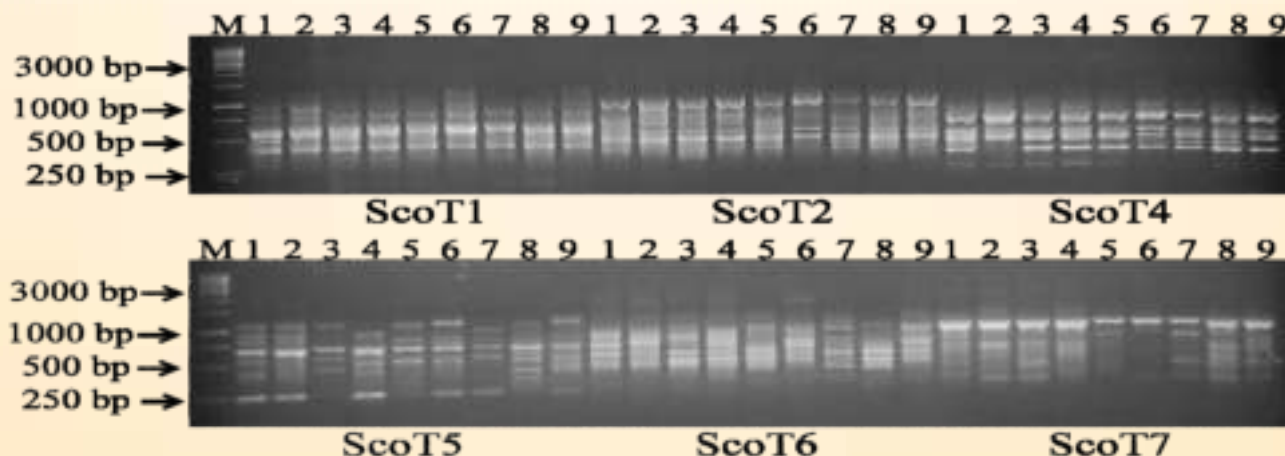


Fig. 13. Assessment of phylogenetic relationship among 9 male date palm genotypes

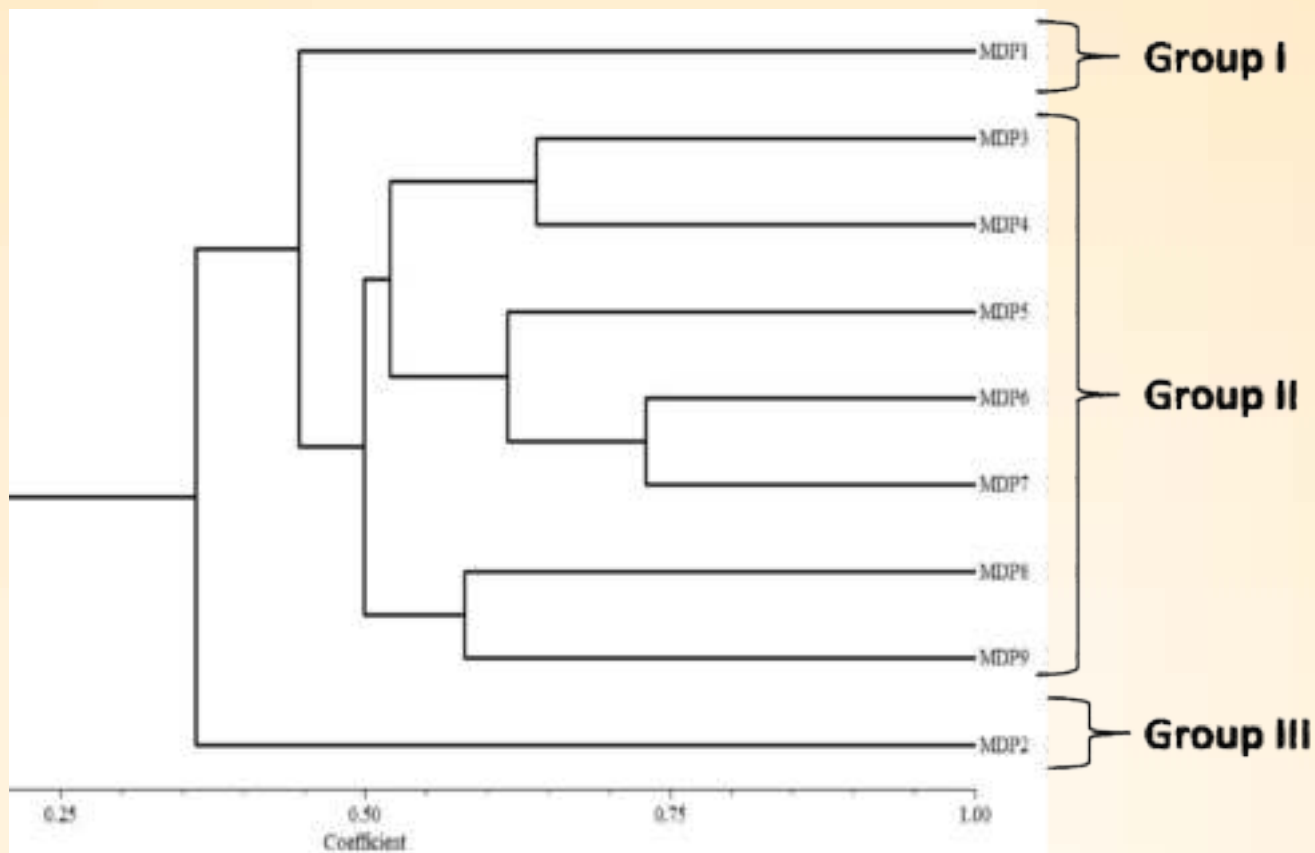


Fig. 14. UPGMA clustering analysis.

**DNA fingerprinting of date palm genotypes**

The germplasm of (MRKS, MHN/B and MIN1) was characterized for fruiting and yield attributing characteristics and observed the similarity with Barhee and Medjool cultivars of date palm, hence checking the duplicacy with DNA fingerprinting using 27 scoT markers were profiled

on genomic DNA of Medjool, Barhee and three exotic collection of date palm. Out of 27 markers, 14 markers were differentiated the genotypes by amplifying genotype-specific bands. Medjool genotype was seen more differentiation to other 4 genotypes (fig. 15).

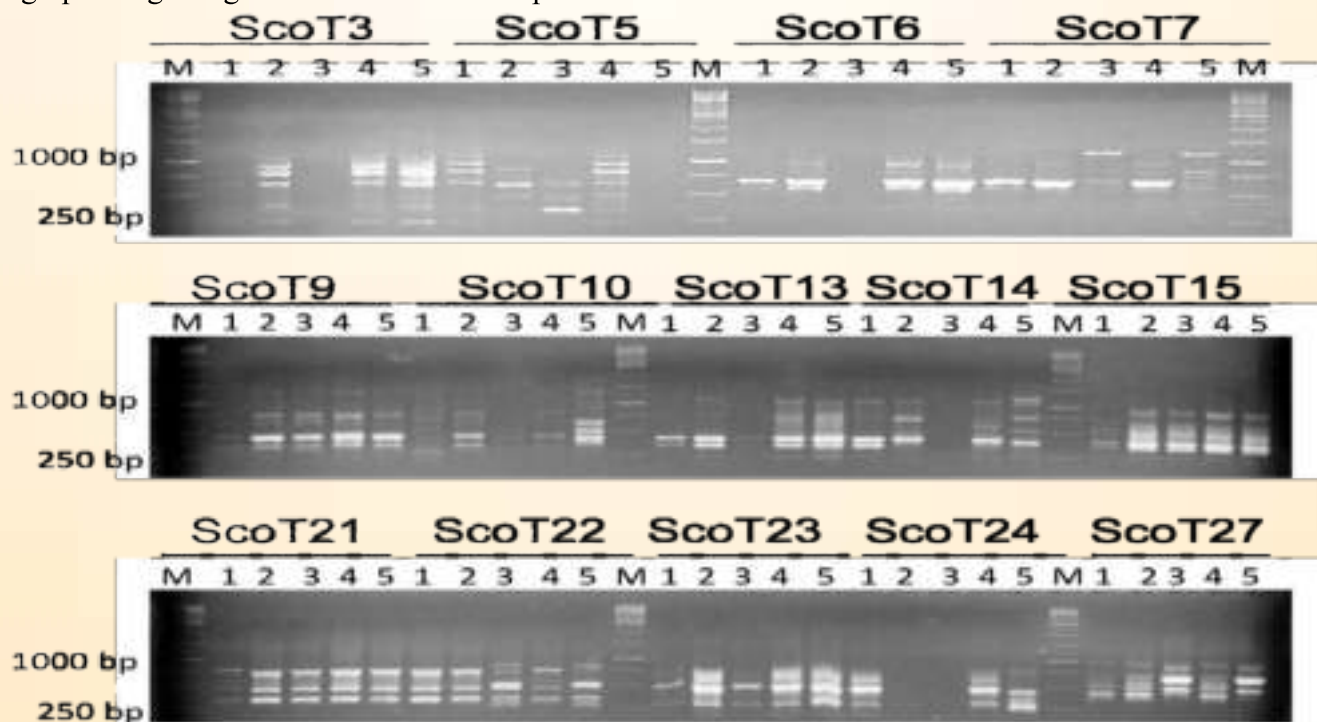


fig. 15. Assessment of phylogenetic relationship in date palm germplasm

➤ **Karonda (*Carissa congesta*)**

**DNA fingerprinting of Karonda cv. Thar Kamal:**

For DNA fingerprinting, leaf samples were collected from karonda cv. Thar Kamal along with 16 field established genotypes used as comparative control for varietal identification and used for molecular profiling of 12 ScoT and 14 CBDP markers. The profiling of ScoT and CBDP markers were done using PCR amplification of marker-specific primers on genomic DNA of Karonda genotypes including Thar Kamal cultivar. The PCR amplicons were analyzed electrophoretically on 1.2% agarose gel and visualized under gel documentation system (Syngene). The banding pattern in 'Thar Kamal' cultivar was scored and fidelity of the specific bands was compared with banding pattern of 16 known genotypes. Out of 14 CBDP markers, twelve markers were got amplified and out of 12 markers, eleven CBDP markers were able to produced 'Thar Kamal' specific bands. The 'Thar Kamal' varietal-specific alleles distribution

along with size. Similarly, out of 12 ScoT markers, five ScoT markers namely ScoT13, ScoT16, ScoT19, ScoT23 and ScoT25 were able to produce 'Thar Kamal' specific band. The CBDP 6, CBDP 9 and CBDP 19 have produced maximum number of varietal specific alleles.

➤ **Pomegranate (*Punica granatum*)**

**Molecular diversity and population structure analysis in pomegranate genotypes :**

The 96 genotypes of pomegranate were characterized using 14 SSR markers. The SSR markers were profiled on isolated genomic DNA using standard PCR protocols. The fourteen SSR markers were produced 40 alleles with an average of 2.85 alleles per primer. The polymorphic efficiency of SSR markers in pomegranate germplasm was calculated by using iMEC software. The PIC value generated by SSR markers was ranged from 0.078 to 0.52 with an average of 4.136. The highest PIC value was exhibited by SSR P4 (0.52) whereas lowest PIC value was exhibited by SSRP 13 (0.078) (fig. 16).

Further, the molecular data were also

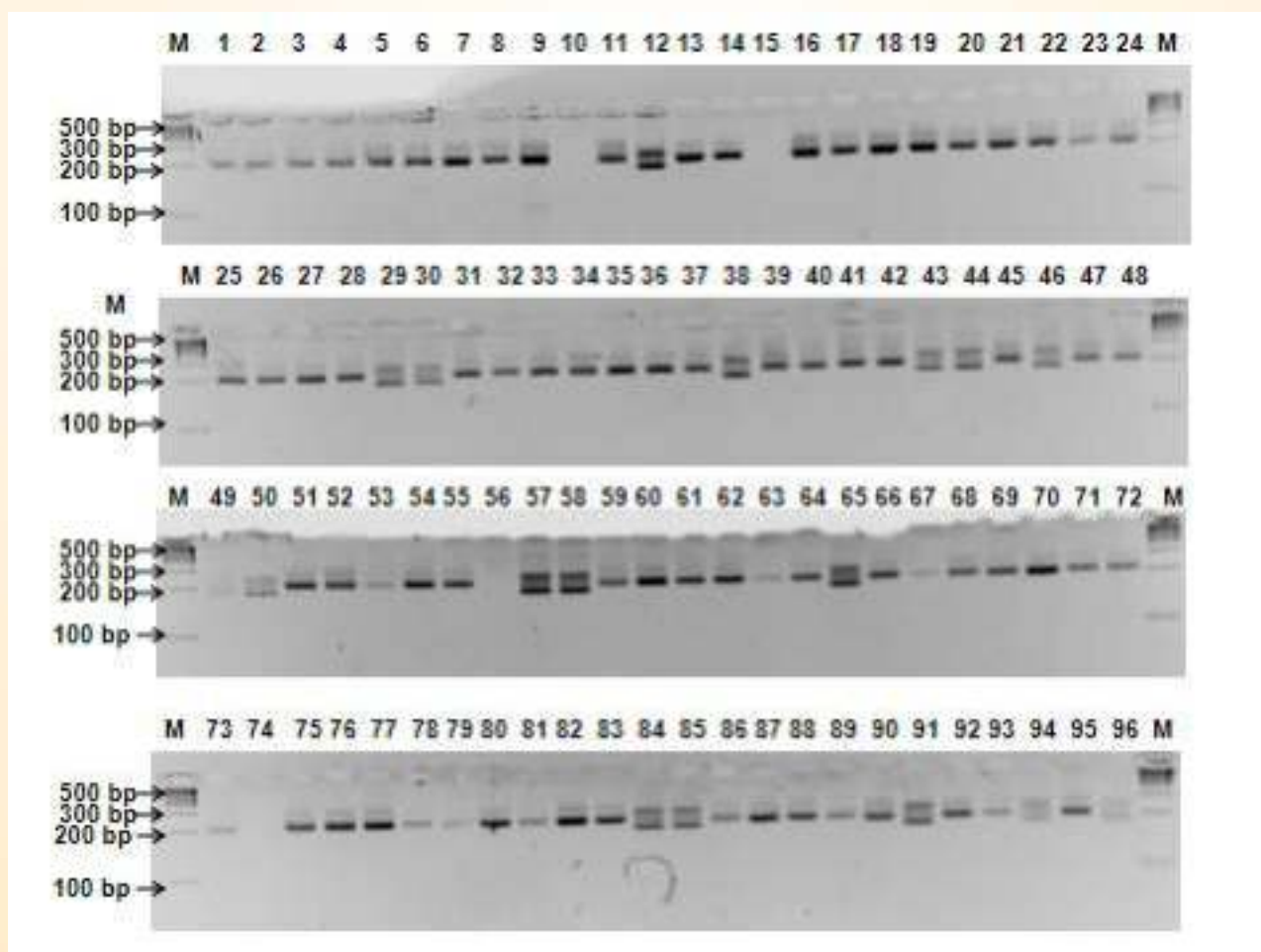


Fig.16 . Representative photograph of SSR marker amplification on genomic DN of 96 genotypes of pomegranate. The numerical 1-96 and M indicate 96 genotypes of pomegranate and 50 bp standard DNA ladder.

analysed for other parameters such as expected heterogeneity index ( $H_e$ ), marker index (MI), effective multiplex ratio (E) and discriminative power (D) pertains to marker efficiency. The heterogeneity ( $H_e$ ) varied from 0.079 to 0.601 with an average of 0.5021. The highest  $H_e$  was exhibited by SSR P4 (0.601) whereas lowest  $H_e$  was exhibited by SSR P13 (0.079). The MI was ranged from 0.079 to 0.601 with an average of 0.5023. The highest MI was exhibited by SSR P4 (0.601) whereas lowest MI was exhibited by SSR P13 (0.079). The SSR P6 and SSR P13 has given MI value below 50% index whereas, the rest of markers were exhibited MI at more than 50% index. The E value of all SSR markers was found one which suggested that all 14 SSR markers are 100% efficient in nature. The D was ranged from 0.352 to 0.97 with an average 0.5882. The highest D was exhibited by SSR E19 (0.97) whereas lowest D was exhibited by SSR P6 (0.352).

Fourteen polymorphic markers were further utilized for diversity analysis among the germplasm. The binary matrix data (0 and 1) were subjected to NTSys software for deriving the UPGMA dendrogram based on the Jaccard's similarity coefficient. The UPGMA clustering of the germplasm of pomegranate was distinguished the germplasm with 0.48-1.00 Jaccard's similarity coefficient. At Jaccard's coefficient 0.48, the 96 genotypes were clustered into two major groups (Group I, Group II). The group II is further divided into three subgroup (IIa, IIb, IIc) at 0.57 Jaccard's similarity coefficient. The Group I is consisted with 24 genotypes. Among them, 10 genotypes were shown 100% similarity coefficient. It can be further divided into 2 subgroups i.e. Ia, Ib at 0.65 similarity coefficient with 15 and 9 genotypes, respectively. The Group II is consisted with 72 genotypes. In which, the subgroup IIa consisted of 43 genotypes and among them 20 genotypes were shown 100% similarity coefficient. The subgroup IIb consisted of 27 genotypes and among them 13 genotypes were shown 100% similarity coefficient. Among the Group II, Group IIc is harboring two genotypes namely S90, S72 as outlier group. Among the total cluster, Group IIa consisted with maximum genotypes. (fig. 17).

Furthermore, the binary matrix data were utilized for population structure analysis using STRUCTURE 2.0 software and Structure Harvester tool. The analysis revealed three major population including admixtures within populations. The purity and admixtures among the genotypes were also analysed based on the bar length index value. Numbers of populations were equal to 3. Number of accessions in population-I were 28 out of which 3 (42, 52 and 54) were found true to type (pure) genotypes. Number of accessions

in populations-II was 24 out of which 16 unique accessions were observed with 100% purity. Number of accessions in population-III were 42 and in some cases, admixture type of genotypes in the population observed were two (56;90). The populations-I and III are shown more admixtures as compare to population-II which was showed pure type of population with some extend (fig. 18).

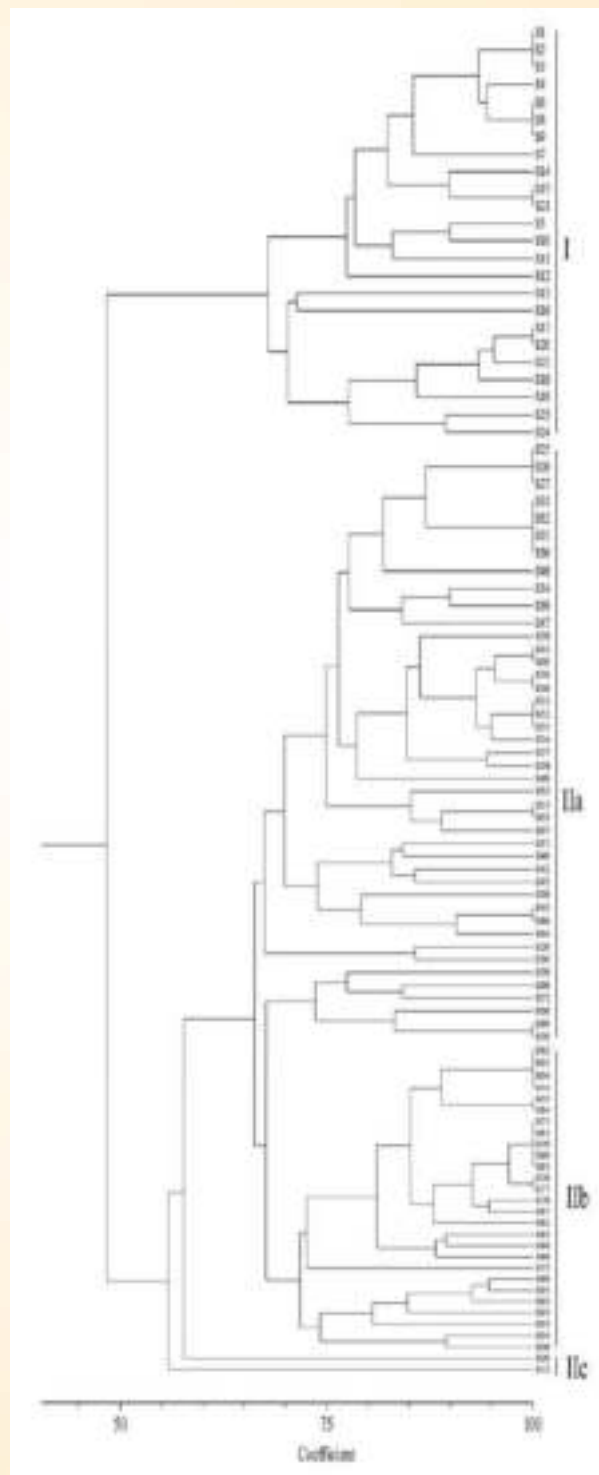


Fig. 17. Representative photograph of SSR marker amplification on genomic DN of 96 genotypes of pomegranate. The numerical 1-96 and M indicate 96 genotypes of pomegranate and 50 bp standard DNA ladder

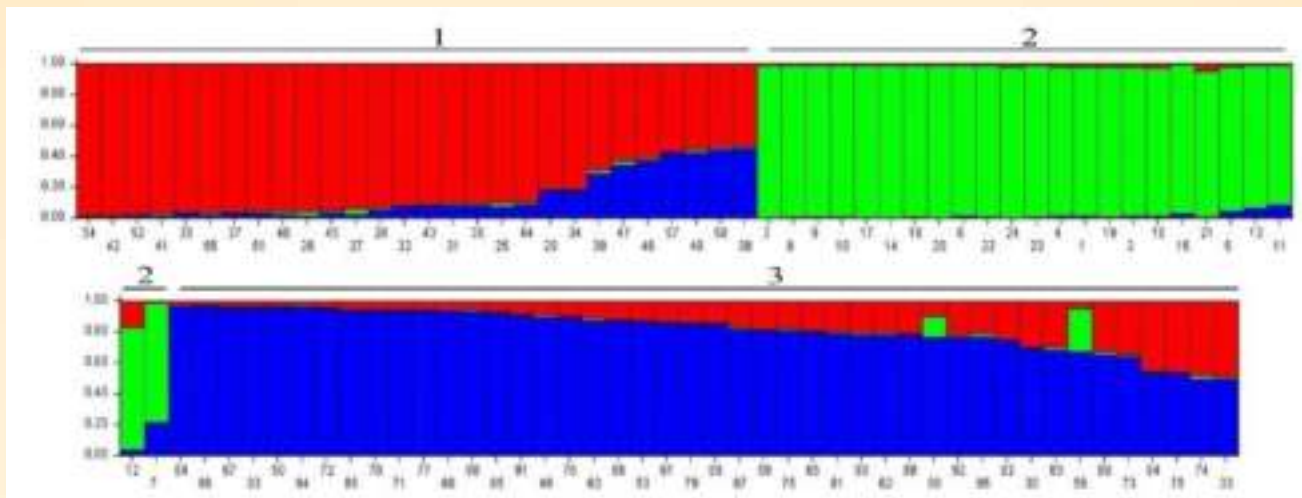


Fig. 18. Bar graphe indicating number of populations along with admixtures.

### 3.2 IMPROVEMENT IN VEGETABLE CROP PLANTS

During the period, the conserved germplasm monitored and maintained in gene bank facility of the institute. The unique germplasm deposited to NBPGR and IC number's is obtained for water melon AHW/BR-37 (0644728 & 28), jhar karela CIAH MB-1 (0644742), sehjan AHMO-1 (0644045), kumat AHAS-1 (0644044), tumba AHT-1 (0644741), guarpatha AHAB-S-1 (0634265), AHAB-B-1 (0634267) and AHAB-B-2 (0634266) and brinjal Thar Rachit (0635987) and CIAH-22 (0635988) and from CHES regional station allotted IC (Indigenous collection) number dolichos bean (13) from IC-631574 to IC-631586 and vegetable cowpea (3) from IC-631587 to IC-631589.

#### 3.2.1 Survey and collection

The systematic survey was done and collected 10 genotypes of Okra, 12 genotypes of Chilli, 6 germplasm of cucumber-*Cucumis sativus* L., 3 germplasm of pumpkin- *Cucurbita moschata* (mini box type) and one of *Moringa oleifera* L. were collected based on their morphological traits.

#### 3.2.2 Evaluation and maintenance

➤ **Velvet bean (*Mucuna pruriens*):** Velvet bean AHVB-1 is unique germplasm and stored seed was studied after 10 years as repeated experiment. It is vigorous in plant growth and prolific in pod bearing, and yield and quality observations recorded as rainy-winter season crop. The genotype bears 12-15 clusters/plant and 7-14 pods/cluster. Tender pods at marketable stages are

green in color with velvety surface having tiny hairs. Mature pods recorded 32-40 g weight, 11.4-12.6 cm length and 1.9-2.4 cm width. Each pod containing 5-6 seeds which are dark brown in color, 1.7-2.1 cm length and 1.2-1.4 cm width. Crop damaged completely due to severe low temperature (minus 4°C) and frost conditions observed on 16/01/2022 at CIAH farm.



Tender pods of velvet bean AHVB-1



Flowering pattern in velvet bean AHVB-1

➤ **Cowpea and brinjal:** During the rainy-winter season of 2022, AICRP (VC) entries of cowpea (7) and brinjal (13) were assessed for genotypic performance and yield potential as AVT-I and over the years under hot arid climate. Trials consisted of two entries each from CIAH, Bikaner i.e. cowpea (AHCP-1-4-1 and AHCP-2-3) and brinjal (Thar Rachit and CIAH-22) as developed for unique quality and yield under heat stressed arid environment.

➤ **Watermelon (*Citrullus lanatus*) advance lines:** During summer season of 2022, evaluated advance lines of watermelon for horticultural traits and the description is given as under.

- **AHW/BR-22:** It produced oblong fruits weighing 2.6-3 kg. Ovary is 1.7-2 cm long and hairy. Fruit length varied from 21-26 cm and diameter is 14-16 cm. Rind is thin (1.2-1.3 cm). Rind colour is dark green devoid of stripes. Flesh colour is red having 11.7-12.4% TSS. Seed are small in size and the single fruit contain 250-270 seeds.
- **AHW/BR-25:** It is characterized by entire (non-lobed) leaves. Fruits are round with fruit weight 2.5-3.6 kg, fruit diameter 16.5-19 cm, rind thickness 1.5-2 cm and TSS 11.5-12%. Rind colour is light green having dark green stripes.
- **AHW/BR-43 PL5:** It is characterized by 1.8-2 cm long ovary, 28-32 cm long fruits having light

green rind with very narrow stripes, dark red flesh and bold seeds. The fruit weight, fruit diameter, rind thickness and TSS varied from 3-4.5 kg, 16.5-18 cm, 1.5-1.8 cm and 11-11.8%. Number of seeds per fruit varied from 200-260.

- **AHW/BR-43 PL8:** It produced 1.7-2 cm long and hairy ovary. The fruit weight is 3.8-4 kg having fruit length 30-32 cm with fruit diameter 16-19 cm. Flesh colour is red. Rind is 1.3-1.4 cm thick having clear, wide and green stripes. TSS varied from 11.6-12%.
- **YF 5-2-7:** It is characterized by entire (non-lobed) leaves and saffron coloured flesh (Yellow orange group 21 C). Flesh is high in carotenoid content (9.22 micro gram/ gm FW). Fruits are round weighing 2.6-3.0 kg having dark green rind with very narrow stripes. Rind thickness is 1.2-1.4 cm. Seeds are brown and single fruit contain 280-330 seeds.

**AVT-II Varietal Trial 2019:** During summer season of 2022, five entries of water melon were evaluated and entry 2019/WMVAR-4 produced the maximum marketable yield (237.70 q/ ha).

**AVT-I Varietal Trial 2020:** During summer season of 2022, five entries of water melon were evaluated and 2020/WMVAR-3 recorded the maximum marketable fruit yield (225.88 q/ ha).



AHW/BR-22



AHW/BR-25



AHW/BR-43 PL5



AHW/BR-43 PL8



YF 5-2-7

➤ **Jhaar karela (*Momordica balsamina*)**

During rainy season of 2022, evaluated a promising line (CIAHMB-1; IC-0644742) that produced 200-230 fruits/ plant (fig. 19). The fruit weight, fruit diameter and fruit length ranges from 7.30-9 g, 2.1-2.6 cm and 3.2-4.5 cm, respectively. The length of ovary varied from 0.4-0.7 cm. Recorded 10.9-15.2% dry matter content in fruits at edible stage. Also conducted evaluation trials on CIAHMB-1 at KVK, Phalodi and KVK, Chomu which produced 40-50 q/ ha and 31.75 q/ha yield, respectively.



Fig. 19. CIAHMB-1 (IC-0644742): A promising line of *Jhaar karela*

**Muskmelon (*Cucumis melo*)**

During the summer season of 2022, evaluated thirty germplasm of muskmelon which were showed wide genetic variability with respect to different qualitative and quantitative traits (table

8). Based on the performance during last year's, submitted two muskmelon entries viz., AHMM/BR-35 and AHMM/BR-47 (Thar Mahima) for multi-location testing under AICRP (VC).

Table 8. Genetic variability among muskmelon germplasm

S.No.	Trait	Range
1.	Fruit weight (kg)	0.5-1.2 kg
2.	Fruit diameter (cm)	10.5-13.2 cm
3.	Fruit length	9.0-15.2 cm
4.	Flesh thickness	1.5-3.0 cm
5.	Rind thickness	0.1-0.3 cm
6.	No. of sutures	8-12
7.	Total soluble solids	8.0-13.8 %



Variability in leaf traits



Variability in fruit traits

➤ **Dolichos bean (*Dolichos lablab*)**

Total 123 germplasm were maintained at CHES, Vejalpur and promising lines for horticulture traits were described as under.

**CHESDB 31:** The pods are attractive light greenish white in colour. The pods are long having an average pod length of 14.23cm and an average pod girth of 4.21cm with pod weight of 8.5g. The fresh pods were harvested at 115 to 120 days after sowing. A total of 900-1250 pods per plant with on an average yield of 6- 7 kg/plant of fresh pods under the dry land semi arid conditions. This genotype has nutritional value in terms of proteins (4.2g/100g), ascorbic acid (7.7 g/100g), β-carotene (7.2 mg/100g) on fresh weight basis and other antioxidants like total phenols (138.2 mg GAE/100g), flavonoids (12.6 mg cat.equi/100g) and Total antioxidants (158.6.5 mgAAE/100g).



Promising CHESDB-31 (*Dolichos bean*) genotype

**CHESDB-01:** This genotype has attractive long flat and green pod colour. The pods are long having a pod length of 14.0 cm and pod girth of 5.5cm with pod weight of 10.0g. The first harvest of fresh pods starts at 90 to 95 days after sowing. A total of 800-1200 pods per plant with on an average yield of 6-



6.5 kg/plant of fresh pods are obtained under the dry land semi arid conditions. This genotype rich in proteins (4.2g/100g), ascorbic acid (8.8 mg/100g),  $\beta$ -carotenes (11.8mg/100g) on fresh weight basis, flavonoids (36.2 mg cat.equi/100g) and other antioxidants.



peak pod bearing in CHESDB-01(Dolichos bean) genotype

**CHESDB-10:** The pods are very attractive creamy whitish green in colour. The pods are broad, having an average pod length of 16.00cm and an average pod girth of 6.2cm with pod weight of 11.5g. The fresh creamy white broad pods were harvested at 99 to 100 days after sowing. The total number of pods per plant was 750-1200 with an average yield of 6.5-7.5kg/plant of fresh pods under rainfed semi arid conditions.



Performance of CHESDB-10 (long broad pods) (Dolichos bean) genotype

**CHESDB-40:** The pods are light purple in colour. The pods are sickle shaped having pod length of 15.5cm and pod girth of 4.0cm with pod weight of 7-7.5g. The fresh pods were harvested at 95 to 97 days after sowing. The total number of pods per plant was 900-1400 with yield of 7.0to 8.5 kg/plant of fresh pods. This genotype found field resistance to dolichos bean yellow mosaic virus disease under

field conditions.



Promising CHESDB-40 (Dolichos bean) genotype

➤ **Vegetable cowpea (*Vigna unguiculata*)**

The promising genotypes were evaluated for their morphological, yield and quality attributes under rainfed semi-arid conditions at Central Horticultural Experimental Station (ICAR-CIAH) Vejalpur, Godhra, Gujarat. Among them, the genotypes (Yardlong bean) like CHESVC-01, CHESVC-15, CHESVC-16, CHESVC-22, CHESVC-27, CHESVC-46, CHESVC-45 and CHESVC-20 (bush type) were superior with respect to fresh number pods and pod yield.

**CHESVC-01:** The genotype CHESVC-01 having attractive long parrot green pod appearance. It is an early flowering and early maturing genotype. It takes 38-40 days for first flowering and 48-50 days after sowing for first harvesting of fresh tender parrot green colour pods. It is having long (66.0cm) parrot green colour pods. The pods have 66.0cm length, 3.4cm girth and 32.10g pod weight. The total number of pods per plant varies 80-120 pods per plant with yield of 2-2.5 kg per plant of fresh pods.



Performance of genotype CHESVC-01

**CHESVC-22:** The pods are attractive red in colour. The pods are long having an average pod length of 36.8cm and pod girth of 2.6cm with pod weight of 13.2g. The fresh tender red pods were harvested at 64-65 days after sowing.

**CHESVC-45:** The pods are attractive red in colour and cluster bearing genotype with four pods per cluster. The pods are medium long having an average pod length of 31.0cm and an average pod girth of 2.5cm with pod weight of 9.2g. The fresh tender pods were harvested at 60-62 days after sowing.



CHESVC-22 and CHESVC-45 Heavy bearer: Red colour pods

➤ **Yard long bean (*Vigna unguiculata subsp. sesquipedalis*)**

**CHESVC-15:** The pods are dark red in colour. It is an early flowering and early maturing genotype and takes 35-38 days for first flowering and 44-46 days after sowing for first harvesting of fresh tender pods. The pods have 52.0-54.0cm length, 2.6cm girth and 22.0-23.0g pod weight. The total number of pods per plant varies 180-200 pods/plant with an average yield of 2.0 to 3.0kg/plant of fresh pods. This genotype also recorded for higher nutritional value in terms of proteins (5.2mg/100g), ascorbic acid (17.2mg/100g), calcium 258.50 mg/100g), magnesium (226.6 mg/100g), phosphorus (212.84 mg/100g), sodium (12.0 mg/100g), potassium (394.5 mg/100g) and iron (3.96 mg/100g). Antioxidants like Anthocyanins (180-200mg/100g), total phenols (3.17 mg/g) and total antioxidant activity (19.24 $\mu$ .moltrolox.equi./g).

**CHESVC-16:** It is an early flowering and early maturing genotype and takes 29-30days for first flowering and 38-42 days after sowing for first

harvesting of fresh tender pods. The pods are attractive light green in colour having 50.0-52.0cm length, 3.2cm girth and 28.0-30.0g pod weight. The total number of pods per plant varies 150-180 pods/plant with an average yield of 2.5 to 3.5kg/plant of fresh pods. This genotype also recorded for higher nutritional value in terms of proteins (5.8mg/100g), ascorbic acid (18.5 mg/100g), calcium (268.30 mg/100g), magnesium (262.6 mg/100g), phosphorus (155.96 mg/100g), sodium (8.0 mg/100g), potassium (316.5 mg/100g) and iron (4.3 mg/100g). Antioxidants like total phenols (2.8 mg/g) and total antioxidant activity (18.7  $\mu$ .moltrolox.equi./g).



CHES VC-15

CHES VC-16

Pods

**CHESVC-20:** This genotype is a bush and photo insensitive type. It is having short stature (bushy growth habit) grows up to of 40-50 cm height. Pods are pale green in colour, having an average pod length of 17.50cm and an average pod girth of 2.3cm with pod weight of 5.8g and days taken for first flowering is 43-45 days. The total number of pods per plant varies 120-130 with an average yield of 0.8- 1kg/plant of fresh pods.



CHESVC-20: Dwarf stature and photo-insensitive

➤ **Cluster bean (*Cymopsis tetragonoloba*)**

The Cluster bean genotypes were evaluated for their morphological, yield and quality attributes under rainfed semi-arid conditions. Among them, the genotypes like CHESCB-60, CHESCB-59, CHESCB-25 and CHESCB-24 are superior with

respect to fresh number pods and pod yield. The promising genotypes (CHESCB-25 and CHESCB-24) for their different horticultural traits are given below.

**CHESCB-25:** It is single stem growth behaviour with green colour pods, having an average pod length of 11.00cm and an average pod girth of 2.5cm with pod weight of 3.93 g. The total number of pods per plant varies 280-320 with an average yield of 1.2kg/plant of fresh pods.

**CHESCB-24:** It is single stem growth behaviour with green colour pods, having an average pod length of 11.02 cm and an average pod girth of 2.8cm with pod weight of 3.12g. The total number of pods per plant varies 300-320 with an average yield of 1kg/plant of fresh pods.



Performance of cluster bean genotypes

➤ **Bottle gourd (*Lagenaria siceraria*)**

The promising lines of bottle gourd viz. LS-2 1xLS14-1, LS-28xLS-20-2, LS3xLS-LS42xLS32-2 and Baina along with varieties (Th Avani, Thar Samridhi, Pusa Sandesh and Arl Bahar) were evaluated for different horticultural traits. The line LS-28xLS-20-2 (long type) w recorded total number of fruits per plant and yield per plant 19 and 15.6 kg, respectively.

➤ **Cucumber (*Cucumis sativus*)**

Four native cucumber germplasm (CHES C-1 to 4) were collected and evaluated for generating preliminary data at station for their growth, yield and quality parameters. The selfing was done for further multiplication and evaluation.

➤ **Ivy gourd (*Coccinia grandis*)**

Twenty six gynoeceous accessions maintained under field conditions at CHES and evaluated to assess the genetic divergence through principal component and cluster analysis. High PCV and GCV were recorded for NFFP (25.13 and

22.20), PL (23.14 and 20.69), FD (24.01 and 21.46), AFW (22.98 and 20.13), NFPY (26.38 and 24.40), FYP (37.57 and 31.29), FY (35.55 and 33.20) respectively. High heritability coupled with high genetic advance as per cent of mean was observed for VL, IL, NFFP, FL, PL, FD, AFW, NFPY, FYP, FY, The FYP showed significant positive correlation with VL (0.6833), IL (0.2991), NFFP (0.8107), FD (0.5245), AFW (0.6766), NFPY (0.7659). CHESIG-2 genotypes had distinctly higher fruit yield 31.62 kg/plant than the other genotypes (fig. 20).



Different view of cucurbits

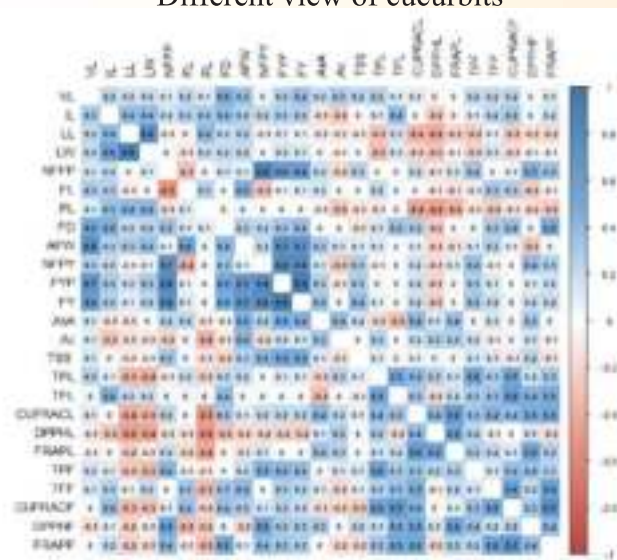


Fig. 20. Graphical representation of correlation coefficients for growth, yield and quality traits in ivy gourd (Diagonally above is phenotypic and below is genotypic correlation coefficients).

➤ **Spine gourd (*Momordica dioica*)**

Twenty-eight genotypes were evaluated for their different morphological and quality traits and based on their performance; three accessions were found elite namely CHESG 1, CHESG 11 and CHESG 15. The accession CHESG 1 recorded uniform round oblong or conical or elliptical fruits with medium spines of light-green colour. It also has fruit weight

(15.4-20.6 g), less seeded (16-20), high yield potential (1.6-2.8 kg/plant) with dark-green and round fruits along with small spines attributing to consumer preference. The fruits are rich in ascorbic acid (423.7 mg/100 g). Its vine is thin and spreading which grows very well on 4-line wire-trellis system. Its fruits are 3.5-5.7 cm long and 9.1-9.6 cm diameter with total yield of 5.50 t/ha at spacing of 2 m × 2 m. The plant produces 104-134 fruits in full cropping season (112-

118 days) with sufficient pollinators. Likewise, CHESSG 11 recorded round oblong fruit shape, natural dark green colour, styler end deeply pointed with average fruit weight (30.5 g) and fruit yield (2.59 kg per plant) while, CHESSG 15 recorded conical shape small sized fruit, very small and soft (feathery) spines, and soft seeded with fruit weight (5.5 g) and length of fruit (2.3-2.8 cm).



CHESSG 1



CHESSG 11



CHESSG 15

➤ **Chilli (*Capsicum annum* L.)**

During rainy season of 2022, twenty-nine chilli genotypes were transplanted in first week of July and a wide range of variability was observed in (29) with respect to various morphological traits viz., plant height (29.21 116.84 cm), number of fruits per plant (18.47 151.16), fruit length (2.36 12.89 cm), fruit diameter (0.35 3.90 cm) and average fruit weight (1.88 15.10 g). Simultaneously, sixty-two single plant selections were also done through individual plant selfing to generate advanced inbred lines.



Morphological variation in fruit traits of chilli

➤ **Tomato (*Solanum lycopersicum*)**

The tomato germplasm maintained under -20°C at the institute was taken for evaluation. A total of 28 (including 22 available genotypes at institute, 2 new collection and 4 varieties) were transplanted in the first week of July, 2022. A good amount of variation was observed for plant height (50.8 108.37 cm), days to 50 % flowering (47.84 68.54), days to first marketable harvest (82.73 118.80). The range of observations for fruit length, fruit diameter and average fruit weight is 2.35 - 4.24 cm, 2.28 4.22 cm and 7.29 35.39 g, respectively. Biochemical traits like TSS and acidity also showed some amount of variation (2.3 5.5 ° Brix and 0.21 0.64 %, respectively) among the genotypes.

respectively) among the genotypes.



Variability in tomato fruits (shape, size and color)

➤ **Round melon (*Praecitrullus fistulosus*)**

Breeding for high temperature tolerant and fruit quality: During the summer season of 2022, nine round melon genotypes which consisted of institute breeding lines and AICRP (VC) entries including check were evaluated for vine growth, flowering, fruit-set and yield component characters. The round melon performance was repeatedly found very poor as summer crop in arid climate.

➤ **Bottle gourd (*Lagenaria siceraria*)**

Breeding for high temperature tolerant and marketable yield in long fruited bottle gourd: During 2022, the stored seed germplasm of bottle gourd and generated breeding material of about 10 - 15 years old were assembled from refrigerator / deep-freeze facilities, and 52 lines were studied for viability and re-generation parameters. About 60 % genotypes exhibited very poor germination and failed to express vigour for field evaluation.

➤ **Khejri** (*Prosopis cineraria*)

**Evaluation of khejri genotypes:** Fourteen elite genotypes identified by CIAH from 2000-2005 and collected clonally for *ex situ* conservation in *khejri* germplasm plot were maintained with good management practices. Khejri variety Thar Shobha and Thar Amruta studied in reference to training-pruning/lopping practices, and growth, pod yield and bio-mass production over the years under rainfed conditions. Khejri Selection3 studied for pod quality, sangri yield and picking intervals in response to training-pruning and it was observed on about 10 years old seedling plant which bearing very long pods.

➤ **Muskmelon** (*Cucumis melo*)

**Thar Mahima:** Thar Mahima is an improved variety of muskmelon developed through single plant selection method. It is promising with respect to first fruit picking (75-80 DAS), high TSS (11.58-11.80%), fruits weighing 780-900 g with 2.8-3.2 cm thick flesh having salmon orange colour, 0.30-0.48 cm thick rind and small seed cavity (2.8-3.2 cm). It produced 4-5 fruits per plant which are round and attractive with netted surface having sutures. Leaves have deep lobing. Flesh colour is orange (Orange group 24 C). It is responsive to low tunnel and net house cultivation. It produced an average marketable fruit yield of 193.7 q/ha.



Musk melon variety Thar Mahima

➤ **Ridge gourd** (*Luffa acutangula*)

**Thar Karni:** It is early in harvesting and takes 51-55 days to first picking from sowing. Fruits 20-25 cm long weighing 90-110 g and cylindrical with 10 longitudinal shallow ridges. Plants bear short internodes and profusely branched. Yield potential is 180-240 q/ha. It is suitable for cultivation during spring-summer and *kharif* seasons. It is tolerant to mosaic disease under field conditions. Tolerant to high

temperature during summer season under hot arid conditions. Recommended for notification during the 29<sup>th</sup> meeting of Central Sub-Committee on Crop Standards, Notification and Release of Varieties for Horticultural Crops held on 23<sup>rd</sup> March, 2022 at New Delhi and subsequently notified vide Gazette Notification number S.O. 3254 (E) dated 20-07-2022 for commercial cultivation in Rajasthan state.



Fig. Ridge gourd variety Thar Karni

**AVT-II Varietal Trial 2019:** Evaluated a total of seven entries of ridge gourd during summer 2022 and found that entry 2019/RIGVAR-6 produced maximum fruit weight (126.13 g), number of fruits/plant (16.13) and marketable fruit yield (132.55 q/ha).

**AVT-II Hybrid Trial 2019:** During summer season of 2022 a total of six entries (hybrids) of ridge gourd were evaluated and 2019/RIGHYB-6 recorded marketable yield (165.93 q/ha) in.

➤ **Longmelon** (*Cucumis melo var. utilissimus*)

**Thar Sheetal:** It is early in harvesting and took 45-50 days in first harvesting from sowing. It produced 25-30 cm long fruits which are light green at tender and edible stage. The fruits are free from bitterness. It is equally suitable for cultivation in spring-summer and *kharif* seasons under open field conditions. Also suitable for cultivation under low tunnels for off-season cultivation. Yield potential varied from 150-200 q/ha. It is able to set fruits at high temperature during summer season under hot arid conditions. Recommended for notification during the 29<sup>th</sup> meeting of Central Sub-Committee on Crop Standards, Notification and Release of Varieties for Horticultural Crops held on 23<sup>rd</sup> March, 2022 at New Delhi and subsequently notified vide Gazette Notification

number S.O. 3254 (E) dated 20-07-2022 for commercial cultivation in Rajasthan state.



Thar Sheetal variety Longmelon

➤ **Dolichos bean (*Dolichos lablab*)**

**Thar Kiran :** It is in vigorous in growth having dark green leaves with purple veins. The whole plant has purple pigmentation in their stem, petiole, flower, leaf veins and pod. The plants have climbing (pole type) growth habit and grow up to 3.5-4.0 m and they require stacking or support. The pods are medium having an average pod length, pod girth and pod weight of 10.8cm, 5.33cm and 8.4g respectively. The fresh purple pods are harvested between 100 to 110 days after sowing. A total of 1100-1600 pods per plant with yield of 7-9 kg/plant of fresh purple pods can be harvested under dry land semi arid conditions with yield potential of 60-63 t/ha. It is rich source of anthocyanins (190 mg/100g), proteins (5.4g/100g) and other antioxidants like total phenols (376.5 mg GAE/100g), flavonoids (42.6 mg cat.equi/100g), total antioxidants (662.5 mg AAE/100g),  $\beta$ -carotene (5.4 mg/100g), ascorbic acid (89.34mg/100g) and lycopene (1.5mg/100g).



Fig. Dolichos bean variety Thar Kiran

**Thar Ganga:** This variety is having attractive long green pod appearance and heavy bearer. The plants have climbing (pole type) growth habit and grow up to 4.5-4.7 m. The plant requires stacking or support. The pods are long with a pod length of 17.5cm and pod

girth 5.21cm with pod weight 15.2g. The first harvest of fresh pods starts at 98 to 110 days after sowing. A total of 800-1200 pods per plant with on an average yield of 8-10 kg/plant of fresh pods can be obtained under the rainfed semi arid conditions. The variety 'Thar Ganga' has higher nutritional value in terms of proteins (4.8g/100g), vitamin-C (7.2 g/100g),  $\beta$ -carotene (12.8 mg/100g) and other antioxidants like total phenols (264.6 mg GAE/100g), flavonoids (40.2 mg cat.equi/100g) and total antioxidants (345.5 mg AAE/100g).



Dolichos bean variety Thar Ganga

➤ **Vegetable cowpea (*Vigna unguiculata*)**

**Thar Jyothi:** It is a photo insensitive type, short stature (50-56 cm height) having dark green leaves and pods which can be cultivated round the year under semi arid conditions.. It takes 40-42 days for first flowering and 48-50 days after sowing for first harvesting of fresh tender dark green colour pods. This variety having an average pod length of 25 to 26.50cm with pod girth of 2.5cm and pod weight of 9.65g. The total number of pods per plant varies between 120-150 and an average yield of 1.5 to 2.0 kg/plant of fresh pods was obtained with yield potential of 20-25 t/ha. The 'Thar Jyothi' is rich in nutritional value in terms of proteins (4.82g/100), ascorbic acid (55.8mg/100g), calcium (460.5 mg/100g), magnesium (252.12 mg/100g), phosphorus (105.64 mg/100g), sodium (20.3 mg/100g), potassium (206.5 mg/100g), iron (5.2 mg/100g). It contains antioxidants like phenols (2.435 mg/g) and total antioxidant activity (14.0 $\mu$ .moltrolox.equi./g).



Vegetable cowpea variety Thar Jyothi

### ➤ Drumstick (*Moringa oleifera*) genotypes

The elite germplasm of *M. oleifera* namely CHESD-34, CHESD-40, CHESD-42, CHESD-45, CHESD-50 were evaluated for important horticultural traits. The CHES D-40 performed well and recorded 2.82 m plant height, 248 pods per plant, 216 g each pod weight, January-March pod maturity, fruit length 45-48 cm and 9-10 seed per pod under rainfed semi arid conditions. The leaves and pods of CHES D-40 recorded higher ascorbic acid, total phenols, flavonoids content. While, CHES D-34 is medium dwarf tree, soft skinned purple colour pods at tender stage suitable for processing; medium length pods rich in magnesium and zinc content. The highest antioxidant potentiality in leaves and pod were measured in CHES D-45 and CHES D-34, respectively. As far as pod length, number of pods and seeds per pod were maximum in Thar Harsha, but yield wise CHESD-42 was better.

### 3.2.4 Biochemical and Biotechnological studies

#### ➤ Drumstick (*Moringa oleifera*)

The thirty four germplasm leaves were performed and displaying relationships among various biochemical in its leaves in cluster dendrogram in five major groups (fig. 21).



Fig. 21. Cluster dendrogram

#### ➤ Ivy gourd (*Coccinia grandis*)

Twenty six ivy gourd accessions in to six clusters composition of ivy gourd were evaluated fruits quality parameters under rainfed semi-arid conditions. The cluster I has highest cluster mean values in the traits like TPL (22.45), TFL (11.31), CUPRACL (32.84), TPF (14.34), TFF (7.08), CUPRACF (24.32), DPPHF (21.25) and FRAPF (29.19) and lower values in AsC (25.94). The

cluster II exhibited high mean values for AsC (47.29), TFL (9.25), CUPRACL (36.90), FRAPL (41.54), CUPRACF (20.33), DPPHF (23.68) and FRAPF (29.64). The cluster III shown lowest cluster mean values for most of the quality parameters under study (fig. 22).

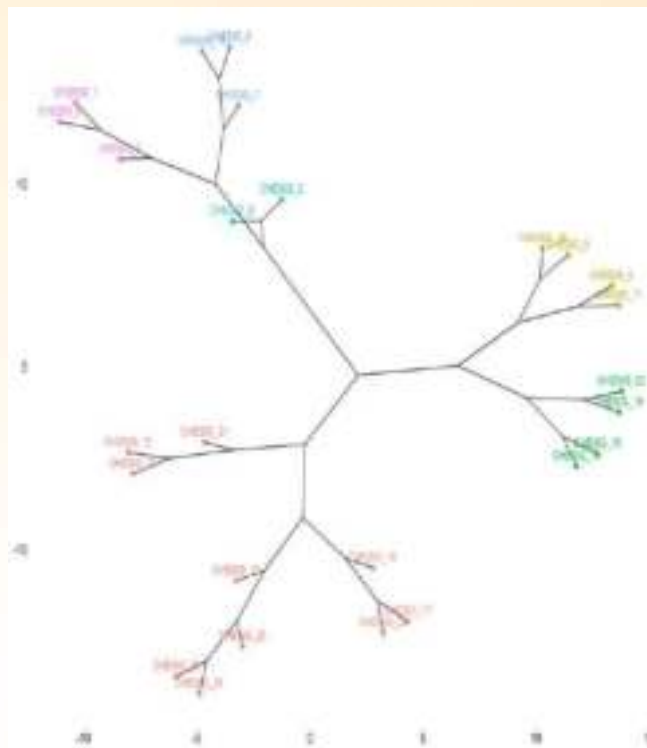


Fig. 22. Cluster tree explains the composition of twenty six ivy gourd accessions in to six clusters

#### ➤ Watermelon (*Citrullus lanatus*)

**Expression analysis of *ClarBOH* genes during multiple abiotic stress conditions :** For validating the involvement of *ClarBOH* genes in multiple abiotic stress conditions in watermelon, the hydroponically grown seedlings of watermelon were subjected to multiple stress treatments like drought (20% PEG6000), salinity (150 mM NaCl), heat (42 °C) and cold (4 °C) and leaf sample were collected at different time intervals. Total RNA was isolated and reverse transcribed into cDNA template and the gene-specific primers of *ClarBOH* were screened on synthesized cDNA. Out of 9 *ClarBOH* genes analysed during cold stress, four genes for instance: *ClarBOH01*, *ClarBOH06*, *ClarBOH07* and *ClarBOH08* were up-regulated at each time point of cold stress. However, the expression of *ClarBOH02* and *ClarBOH09* were repressed up to 3 h of cold stress treatment. Similarly, *ClarBOH08* was shown up-regulation in case of heat stress. *ClarBOH* genes also revealed a differential gene expression pattern under drought and salinity stress. Two genes

namely *ClarBOH07* and *ClarBOH09* were gradually expressed as up-regulated fashion. Rest of the genes were either shown down-regulation or circadian pattern of gene expression. During salinity stress, most of the genes shown down-regulation as compared to 0 h control except *ClarBOH01* and *ClarBOH02* which were up-

regulated at 6 h and 72 h. These results indicated that the *ClarBOH* gene family might have potential roles as candidate genes against abiotic stresses in watermelon (fig. 23).

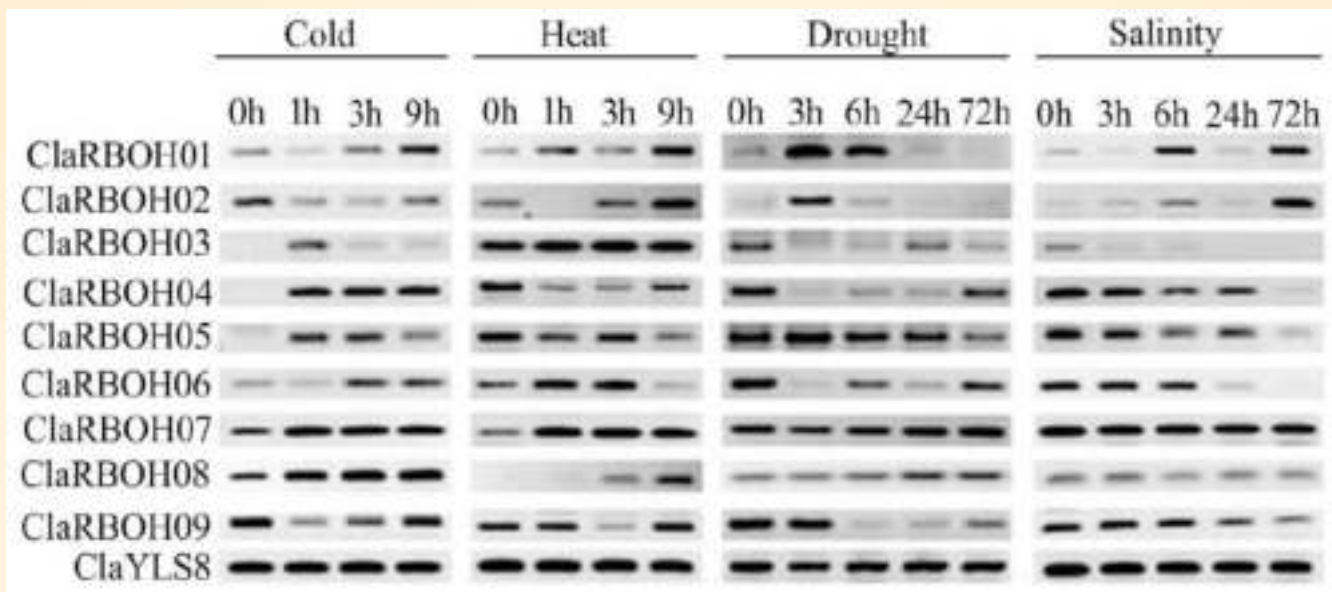


Fig. 23. Expression profiles of ClaRBOH (ClaYLS8 genes used as internal control). The ClaRBOH genes were shown variegated expression pattern according to stress treatment

**DNA fingerprinting of watermelon cultivars using ScoT marker:** For DNA fingerprinting and molecular characterization of 10 watermelon cultivars including 5 advance breeding lines (AHW/BR-5, AHW/BR-25, AHW/BR-37, AHW/BR-43 and YFS-2-7), three released varieties of ICAR-CIAH (AHW-19, AHW-65 and Thar Manak) and two commercially released varieties (Durgapura Kesar and Sugar baby).Thirty four ScoT markers were used for PCR profiling on genomic DNA of watermelon cultivars. All 34 ScoT

markers were produced 197 polymorphic alleles with range of 3 to 7 alleles per locus. The PIC value was ranged from 0.44 to 0.72 with an average value of 0.58. Similarly, the expected heterozygosity (*He*) level was observed in a rage of 0.09 to 0.61 with an average of 0.34. Out of 34 ScoT markers, the ScoT23 and ScoT24 were not produced substantial level of polymorphism among the genotypes, however, ScoT19 and ScoT20 marker has given the best result in terms of polymorphism among the 10 genotypes (fig. 24).

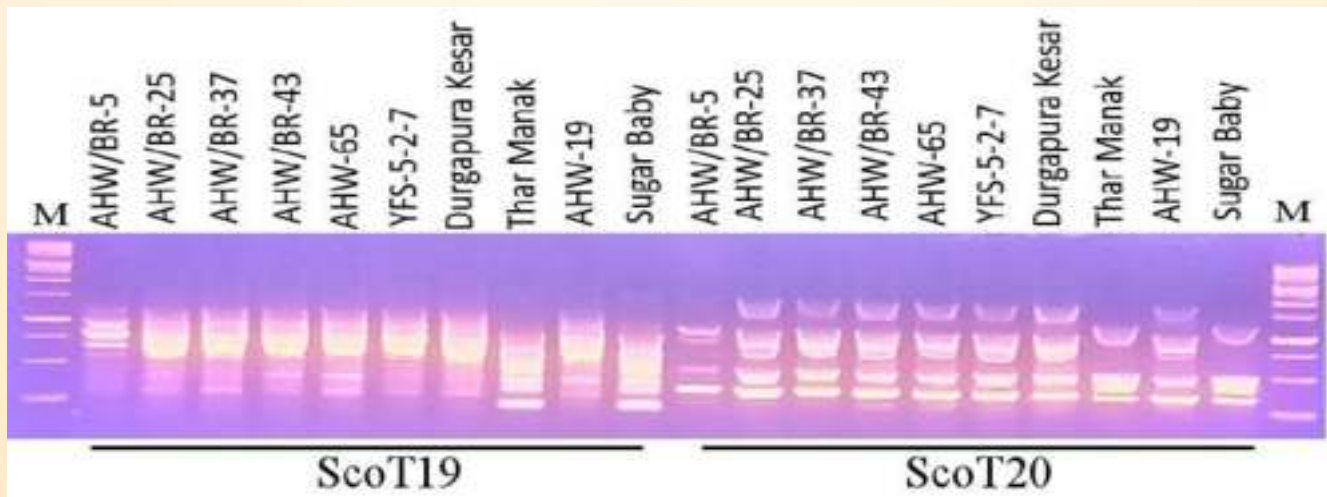


Fig. 24. DNA fingerprinting of watermelon cultivars using ScoT markers.



**DNA fingerprinting of muskmelon cv. Thar Mahima (AHMM/BR-47):** For DNA fingerprinting, leaf samples were collected from Thar Mahima variety of melon along with 6 known varietal genotypes as comparative control of melon. The profiling of 15 CDBP markers was done using PCR amplification of marker-specific primers on genomic DNA of melon varieties including Thar Mahima. The PCR amplicons were analyzed electrophoretically on 1.2% agarose gel and

visualized under Syngene gel documentation system. The banding pattern in Thar Mahima variety was scored and fidelity of the specific bands was compared with banding pattern of 6 known varietal genotypes. Out of 15 CDBP markers, twelve markers were got amplified on genomic DNA of analyzed melon cultivars and out of 12 markers, four CDBP markers namely CDBP2, CDBP4, CDBP5, CDBP7 and CDBP12 were able to produced Thar Mahima-specific bands (fig. 25).

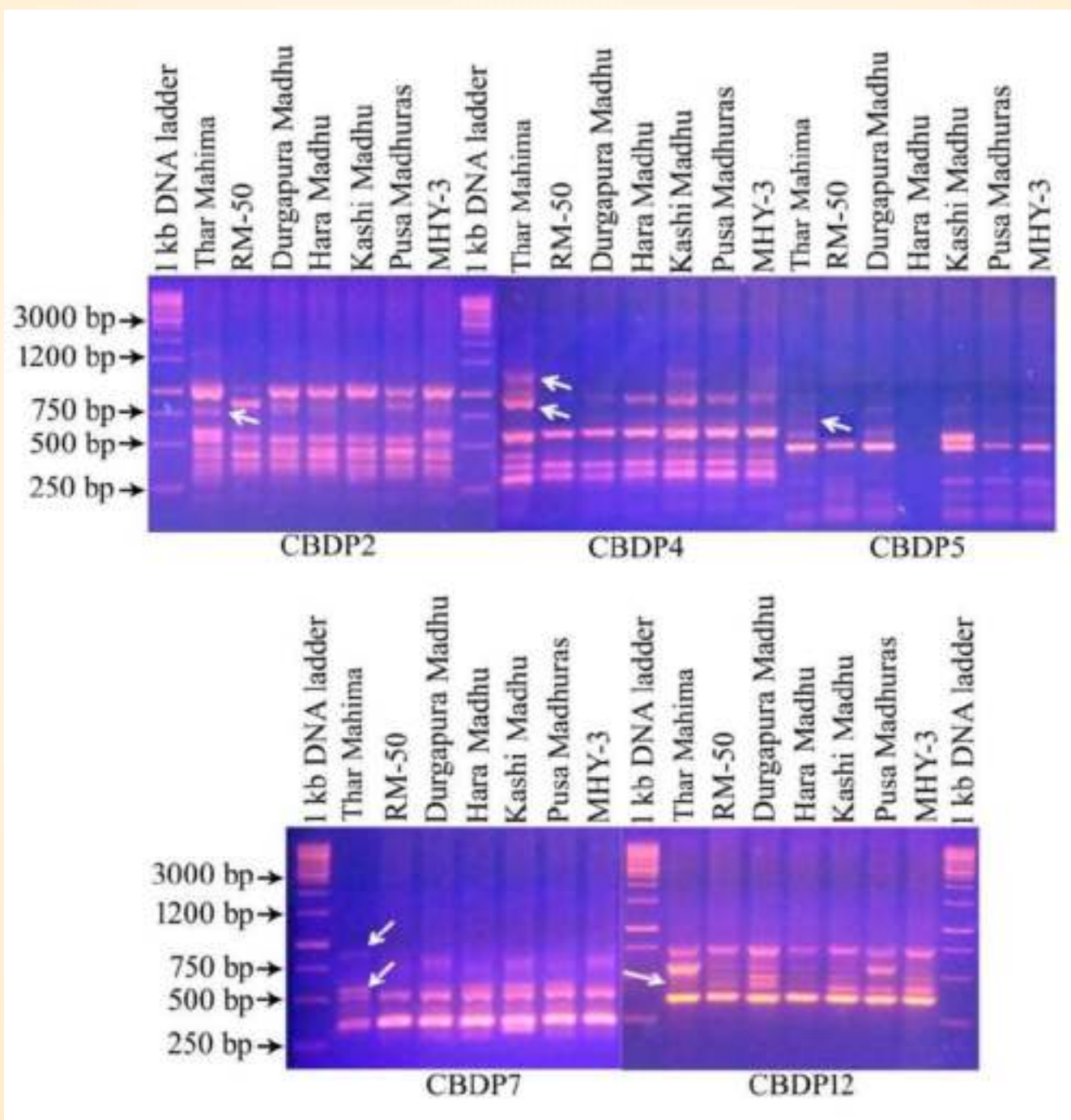


Fig. 25. DNA fingerprinting of melon cv. Thar Mahima using CDBP markers.

### 3.3 CROP PRODUCTION

#### 3.3.1(a) Promising training and pruning systems for ber (*Zizyphus mauritiana* Lamk.)

Training of crop canopy is one of the critical management practices for optimising fruit yield in orchards. Hence, an experiment was carried out to assess the effect of different training systems on different varieties of ber. In this experiment, fruit yield and fruit quality aspects of five year old orchard of ber varieties (Gola, Thai, Goma Kirti & Thar Sevika) were significantly influenced by

training systems (Y shape, Espalier, Telephone and Modified centre leader training). The variety Thai had higher fruits than other varieties while higher fruit yield was recorded in Y-shape among the training systems. However, ber variety Thar Sevika outperformed other varieties with respect to flavonoids, total anti-oxidant and total soluble sugar except phenols. These key metabolites were substantially less in the variety. Among training systems, higher fruit quality components were recorded in Y-shape relative to other training systems (fig. 26, 27, table 9 & 10).

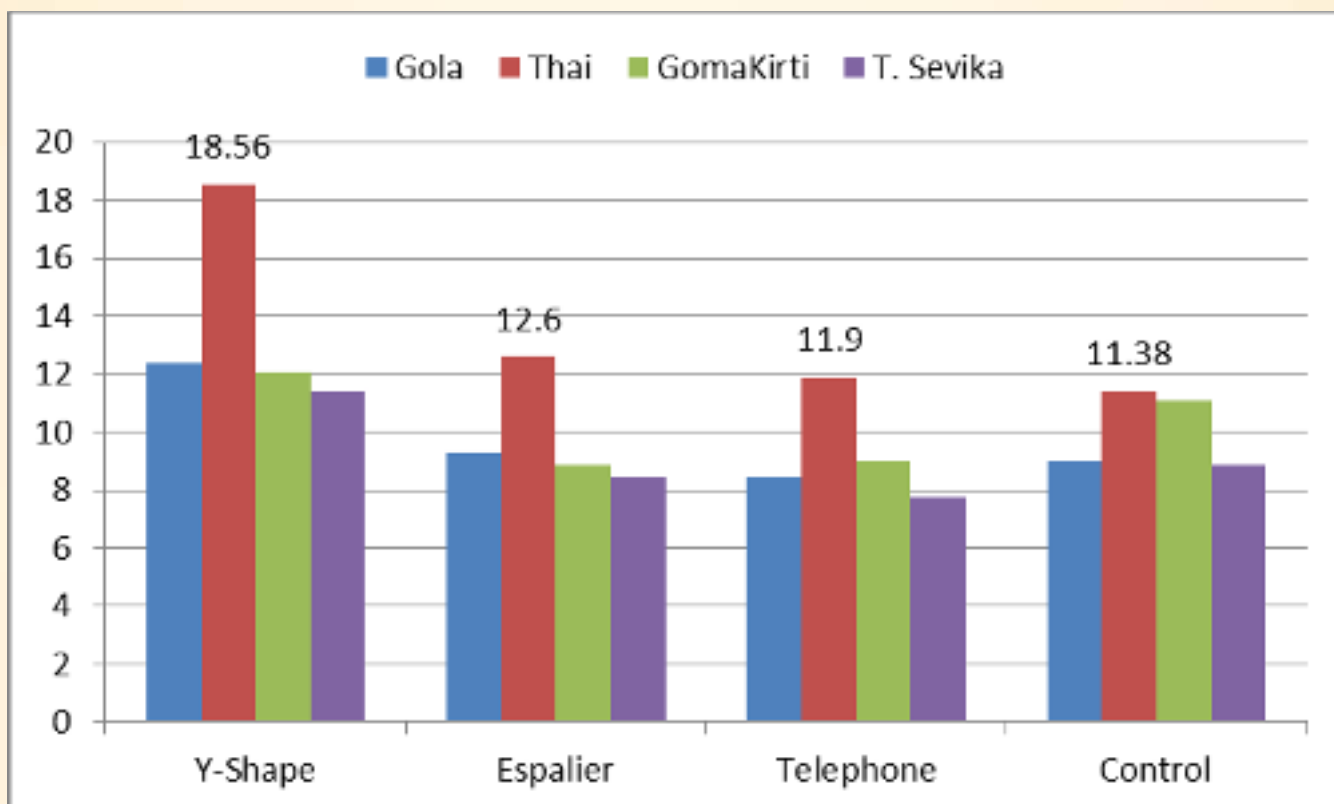


Fig. 26. Yield (t/ha) of ber varieties under different training systems

Table 9. Effect of ber varieties and training systems on Phenol and Flavonoid

Variety	Phenol (mg.GAE/g)					Flavonoid mg/g cat. equ				
	Y Shape	Espalier	Telephone	Control	Mean	Y Shape	Espalier	Telephone	Control	Mean
Gola	2.94	2.57	2.38	2.90	2.70	0.063	0.063	0.067	0.087	0.070
Thai	1.50	1.76	1.59	1.66	1.63	0.053	0.047	0.037	0.037	0.043
Goma Kirti	2.02	1.89	1.96	1.98	1.96	0.047	0.047	0.047	0.043	0.046
T. Sevika	2.14	2.13	2.13	2.55	2.24	0.093	0.083	0.060	0.073	0.077
Mean	2.15	2.09	2.02	2.27		0.064	0.060	0.053	0.060	
	SEm±		CD (P=0.05)			SEm±		CD (P=0.05)		
V	0.007		0.021			0.002		0.006		
T	0.007		0.021			0.002		0.006		
VxT	0.014		0.042			0.004		0.012		

Table 10. Effect of ber varieties and training systems on TAA and Total soluble sugar content

Variety	TAA (mg AAE/g)					Total soluble sugar (%)				
	Y Shape	Espalier	Telephone	Control	Mean	Y Shape	Espalier	Telephone	Control	Mean
Gola	2.92	2.62	2.27	2.58	2.06	6.96	5.95	6.94	5.52	6.34
Thai	1.27	1.18	1.13	1.24	1.20	5.88	6.09	5.30	5.40	5.67
Goma Kirti	1.71	1.42	1.59	1.62	1.59	9.02	8.00	7.60	5.75	7.59
T. Sevika	2.06	1.99	1.85	2.34	2.60	8.81	8.47	6.24	7.00	7.63
Mean	1.99	1.80	1.71	1.94		7.67	7.13	6.52	5.92	
	SEm±		CD (P=0.05)			SEm±		CD (P=0.05)		
V	0.023		0.066			0.070		0.203		
T	0.023		0.066			0.070		0.203		
VxT	0.045		0.131			0.140		0.406		



Fig. 27. Ber varieties trained on Y shape (a), Espalier (b), Telephone (c) and Control (d) training systems

**3.3.1(b) Optimisation of nutrients for ber**

Nutritional trial in Thai ber was carried out with uniformly selected ten plants of each treatment at 6x6 metre spacing during July and nutritional doses were applied as T<sub>1</sub>-100 % RDF (500 g Urea,

700 g DAP & 500 g MOP), T<sub>2</sub>-50 % RDF (250 g Urea, 350 g DAP & 250 g MOP) with 75 kg FYM, T<sub>3</sub>-75 % RDF (375 g Urea, 525 g DAP & 375 g MOP) with 50 kg FYM, T<sub>4</sub>-100 % organic as 150 kg FYM and T<sub>5</sub>-80% RDF through water soluble fertilizers (eight split each

with 200g ). Maximum yield (18.70 kg plant<sup>-1</sup>) was recorded in the plants that received 375 g Urea, 525 g DAP & 375 g MOP with 50 kg FYM (treatment T<sub>3</sub>) followed by T<sub>2</sub> (50 % RDF with 75 kg FYM). This

indicated the possibilities of reduction in use of chemical fertilizer by 25% to 50% without losing fruit yield (table 11.)

Table 11. Effect of plant nutrition on growth and yield of Thai ber

Treatments	Plant height (m)	Stem diameter (cm)	Plant spread (m)		Canopy volume (m <sup>3</sup> )	Leaf chlorophyll (g <sup>-1</sup> fw)	Yield plant <sup>-1</sup> (kg)
			EW	NS			
T <sub>1</sub>	2.58	7.54	4.05	3.65	4.51	0.21	12.60
T <sub>2</sub>	2.60	7.78	5.20	4.70	4.60	0.17	17.50
T <sub>3</sub>	2.50	7.82	4.98	4.46	3.95	0.17	18.70
T <sub>4</sub>	2.52	6.91	4.00	3.60	4.00	0.14	14.42
T <sub>5</sub>	2.55	7.73	4.13	3.70	4.53	0.13	15.33
SEm+	0.04	0.37	0.58	0.44	0.23	0.02	1.22
CD (P=0.05)	NS	NS	NS	0.12	NS	0.06	3.66

**3.3.1 (c) Effect of micronutrients and plant growth regulators on fruit set and retention in ber**

A field experiment on ber cv. Gola was conducted to find out the effect of micronutrients and plant growth regulators on fruit set and retention. Foliar spray of micronutrient (B - 0.1% & Zn - 0.5%) and graded doses (10, 20 & 30 ppm) of plant growth regulators (GA<sub>3</sub>, NAA, kinetin & BA) were applied at green bud (BBCH stage 54) and flower fading *i.e.* most petal fall (BBCH stage 67). Experimental results revealed that at both the green bud stage and flower fading stage, growth regulators considerably affected the fruit set and retention. Among the different treatment combinations, the maximum fruit set was recorded with the application of 0.1 per cent B at BBCH stage 67 (11.42%) followed by the application of 10 ppm

GA<sub>3</sub> at BBCH stage 67 (10.94%). However, both these treatments remained statistically at par with each other. Further, maximum fruit retention was observed with the application of NAA at BBCH stage 67. However, it seems that this treatment helps in retention of more number of fruits primarily because of low crop load. Generally, it was observed that the fruit set had inversely related to fruit retention at physiological maturity. The exception was the application of B (0.1%) either at BBCH stage 54 or 67 and KN (10 ppm) at BBCH stage 67. These two treatments not only increased fruit set but also retained more fruits on trees. From the preliminary observation, we can state that application of B (0.1%) either at BBCH stage 54 or 67 considerably improves fruit set as well as retention in ber cultivar Gola (fig. 28 & 29).

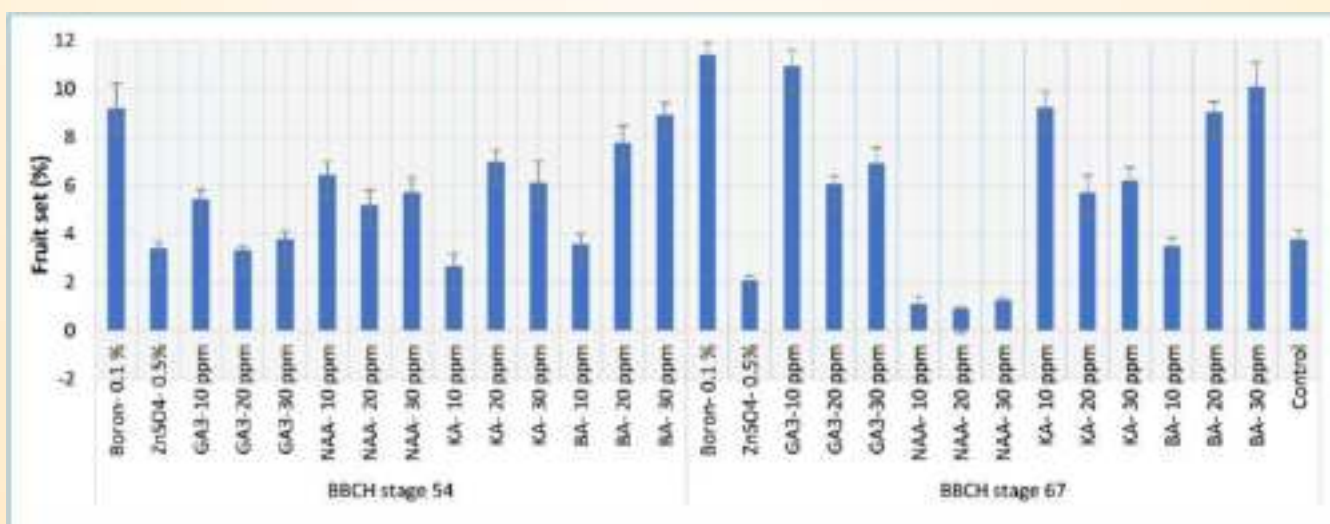


Fig. 28. Effect of interaction of stage and varying concentrations of plant growth regulators and micronutrients on fruit set in Gola cultivar of ber under hot arid region. The bars represent ± S.D. Critical Difference for interaction is 0.893 at P=0.5.

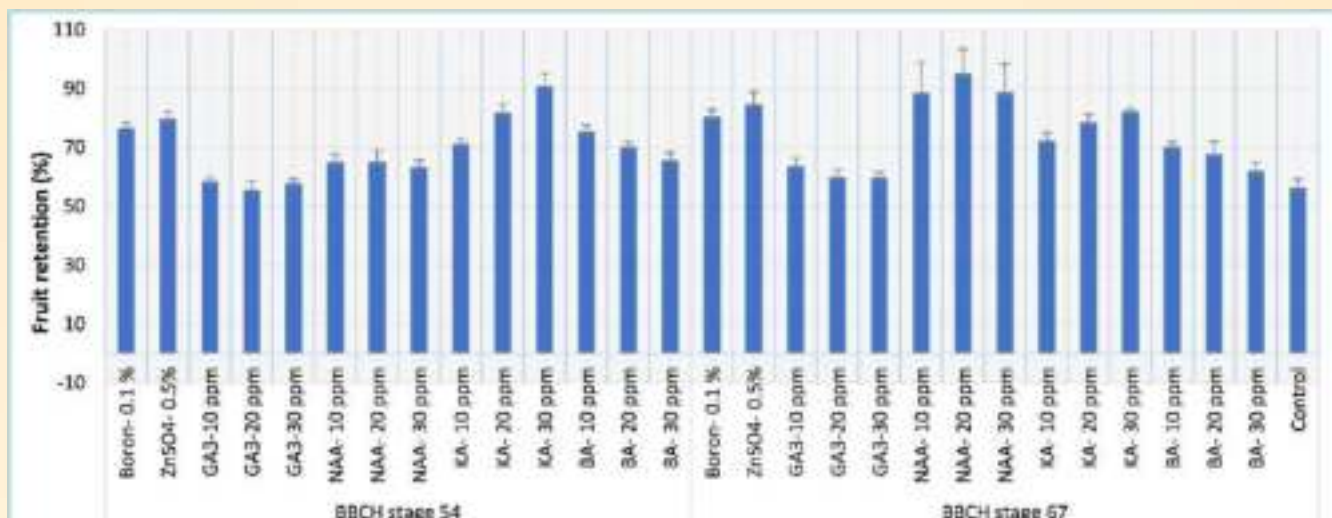


Fig. 29. .Effect of interaction of stage and varying concentrations of plant growth regulators and micronutrients on fruit retention in Gola cultivar of ber under hot arid region. The bars represent  $\pm$  S.D. Critical Difference for interaction is 6.255 at  $P=0.5$ .

**3.3.2(a) Effect of plant architectural engineering on fruit cracking and quality of pomegranate**

Plant architectural engineering that includes canopy management through training and pruning is critical for crops like pomegranate. In this experiment, pomegranate plants were trained in three different ways viz., one, two and four stem training system. The second factor was the branching, which was allowed at one or two feet height from the base. The third factor was pruning of the canopy to an extent of 10 or 20 % of new growth during winter after fruit harvest. Thus 13 different treatments formulated by combinations of three factors were compared with control (without training & pruning) to assess their effect on cracking, yield and quality of fruits. Among

treatment combinations, maximum plant height (2.19 m) was recorded in  $T_1$  (single stem branching at 1 foot + 10 % pruning) followed by  $T_2$  (single stem branching at 1 foot + 20 % pruning) compared to control (1.60 m). Canopy volume (4.34  $m^3$ ), fruits per plant (51) and yield (12.75 kg/plant) were significantly high in  $T_9$  (four stem branching at 1 foot + 10 % pruning) than in any other treatments. The performance of plants subjected to treatment  $T_{10}$  (Four stem branching at 1 foot + 20 % pruning) was also significantly better plants which were subjected to any other treatments. Further, fruit weight was ranged from minimum 210.03 g in  $T_{13}$ -Control without any training and pruning to maximum 255.53 g in  $T_{10}$ -Four stem branching at 1 foot + 20 % pruning (fig. 30).

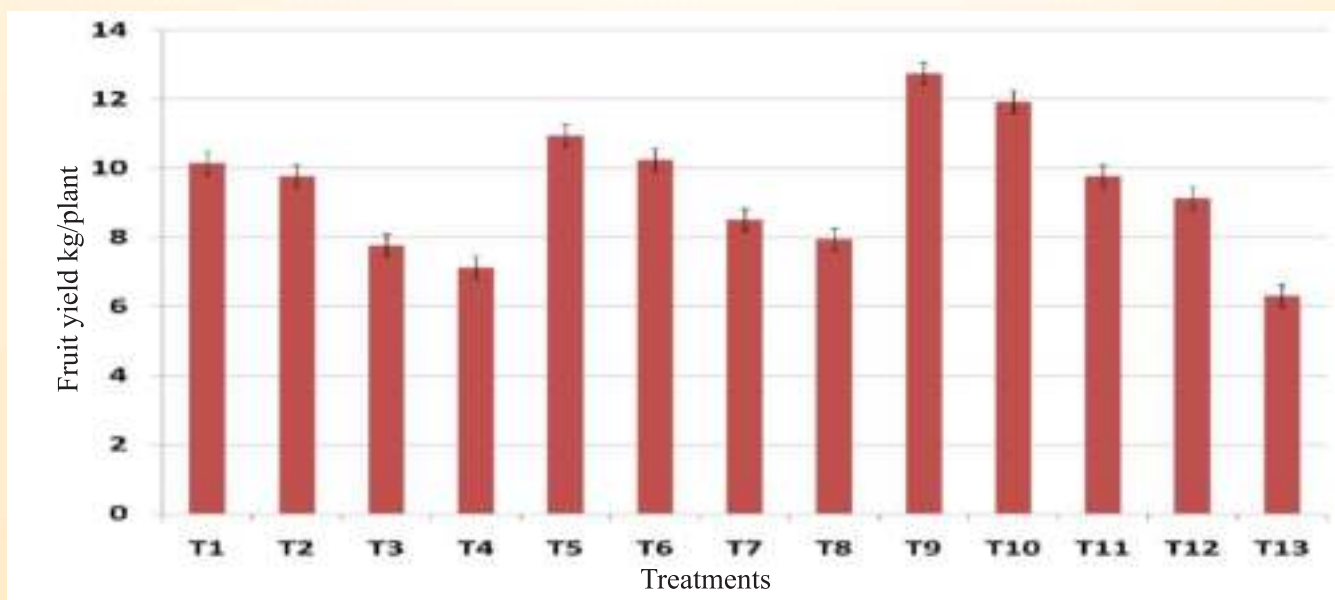


Fig. 30. Effect of plant architectural engineering on fruit yield of pomegranate

**3.3.2(b) Flower regulation and identification of suitable bahar in pomegranate**

In this experiment, plants were subjected to different treatments to regulate flowering. Generally, these treatments are referred as bahar (flowering) treatments, which involve withholding of irrigation for one month prior to *bahar* and 2 ml/l ethrel (40%) application for defoliation in different bahar to improve yield and quality of fruits. For identification of the most suitable bahar treatment for pomegranate grown in arid zone of Rajasthan, experiment was conducted with ten treatment combinations including T<sub>1</sub>-*Ambe bahar* (Jan.-Feb.), T<sub>2</sub>-*Late ambe bahar* (March-April), T<sub>3</sub>-*Mrig bahar* (June-August), T<sub>4</sub>-*Hasta bahar* (Sep.-Oct.), T<sub>5</sub>-*Ambe + Mrig bahar*, T<sub>6</sub>-*Ambe + Hasta bahar*, T<sub>7</sub>-*Late ambe + Hasta bahar*, T<sub>8</sub>-*Mrig + Hasta bahar*, T<sub>9</sub>-*Ambe + Mrig + Hasta bahar* and T<sub>10</sub>-Control

(Natural flowering).

The highest values for diameter (7.50 cm), weight (257.41 g) and number (58) as well as yield of fruits per plant (14.99 kg) were recorded in response to T<sub>3</sub>-*Mrig bahar*. As indicated by values of fruit quality attributes (TSS, acidity, maturity), plants subjected to T<sub>4</sub>-*Hasta bahar* were better than those subjected to other bahar treatments. Aril colour was varied from light pink to dark red while rind colour varied from light red to dark red in response to different *bahar* treatments.

Fruit cracking was substantially low in T<sub>1</sub>-*Ambe bahar* (8.50%) followed by T<sub>2</sub>-*Late ambe bahar* (9.33%) while it was more conspicuous in control (22.50%) and in those subjected to the treatment T<sub>9</sub>-*Ambe + Mrig + Hasta bahar* (20.64 %) (fig 31 & 32).



Fig. 31. Pomegranate cv. Bhagwa during *Mrig bahar*

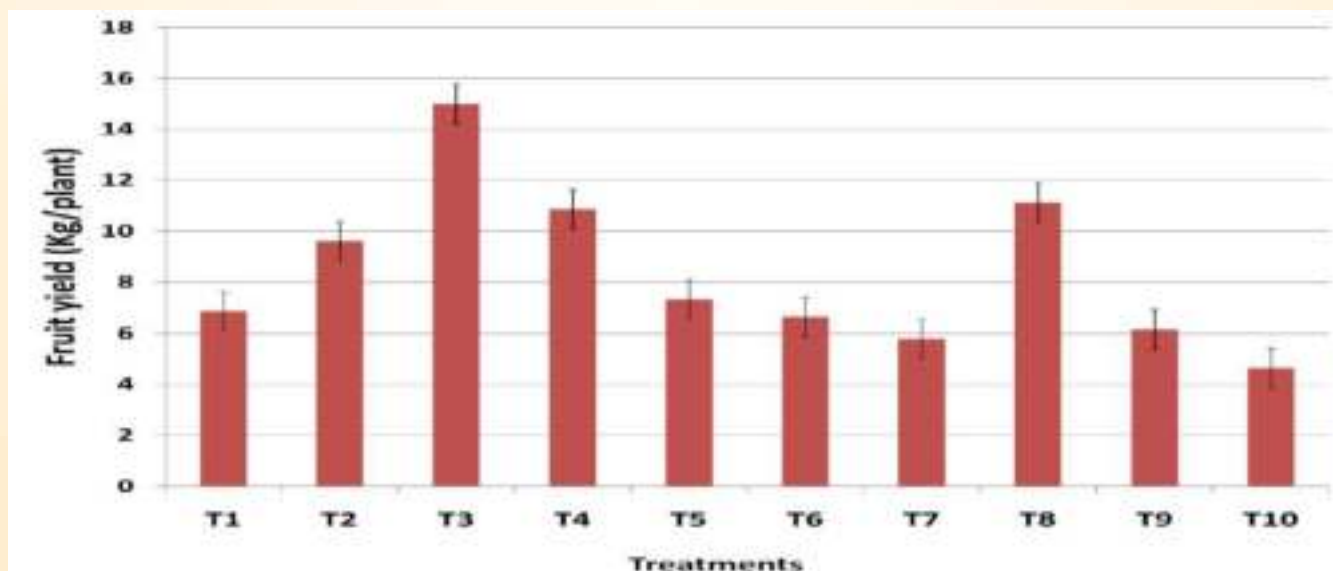


Fig. 32. Effect of flower regulation treatments on fruit yield of pomegranate

### 3.3.3(a) Optimisation of agronomical practices for micro-propagated date palm in hot arid region.

To determine the appropriate pit dimension for micropropagated ( tissue culture) date palm experiments were conducted with different popular cultivars (Barhee, Khalas, Khuneizi and Medjool) at varying pit dimension (0.5 x 0.5 x 0.5 m & 1 x 1 x 1m) and different filling mixtures composition. Results revealed that the date palm cultivars could perform better when pit size was 1 x 1 x 1 m<sup>3</sup> and the pit had 50 Kg FYM + 50 Kg Pond silt and 75 Kg soil gave the best survival (95%), growth increment rate (23% growth per year) in respect of plant height and spread. The analysis of leaf nutrients (major & minor) revealed significantly high N content (1.48%) in Khalas than in Barhee (1.28%). However, there was no significant genotypic variation in the phosphorus content in leaves date palm. The maximum K content (1.55%) was recorded in Khalas followed by Medzool (1.49%) and minimum content was recorded in Barhee (1.33%). The maximum iron (160 ppm) and zinc (48.22 ppm) were observed in cultivar Khalas of date palm. Further, Chlorophyll a, b and total chlorophyll concentration was higher in Khuneizi (1.25, 0.28 & 1.53 mg/g fw) followed by Khalas (1.2, 0.20 & 1.40 mg/g fw) and was low in Barhee (1.10, 0.21 & 1.31 mg/g fw). The fruit drop was relatively very high in Barhee followed by Medjool and was relatively less in Khalas, however, the magnitude of fruit drop was 42 to 61% across

different cultivars and treatments.

### 3.3.3(b) Effects of pollen sources, and pollen storability on productivity of date palm

A field trial was conducted with male palm varieties (Ghanami, Al-In City, IC No. 0632315 and 624490) as a tester and four female lines (Halawy, Khalas, Barhee and Medjool). The male palms were selected on the basis of quantity of pollen produced, time of spath-cracking and existing information about the compatibility with female line. Pollen collected from IC-624490 and Ghanami significantly improved physical parameters of fruits *viz.*, weight, length and width in addition to quality parameters such as pulp weight and TSS (<sup>0</sup>Brix).

### 3.3.3 (c) Pollen storability studies in cultivar Khuneizi

In another study the effect of pollen storage with five different conditions *viz.*, pollen stored at room temperature (T1), pollen stored in refrigerator at 5 °C (T2), pollen stored at - 4 °C (T3), pollen stored in defreeze -20 °C (T4) and fresh pollen used as check (T5). The data revealed that pollen stored in refrigerator and defreeze could be used up to 12 months after collection for pollination as it can lead to fruit set to an extent of 65-80 per cent while fresh pollen fruit set was 89-91 per cent. The experiments also revealed that efficacy of pollen stored at room temperature could be only up to 45-55 per cent.



Pollen storage in refrigerator



Pollen storage at room temperature



Pollen storage in deep freezzer

### 3.3.3(d) Investigation on maturity indices of male palm

Harvesting pollens of date palm at right time is highly crucial for preventing losses which can occur in a short span of time due to spathe burst and wind. Investigation carried out to optimise the pollen collection technology has revealed four reliable indicators to accomplish the task. 1. Harvesting should commence when the position of

male spathe changes from vertical to oblique and starts leaning on the neighboring leaves. 2. The colour of the spathe turns into brown colour. 3. The cracking sound when the spathe is pressed by fingers. and 4. The visible sign of split which is the perfect stage for harvesting. While these are the general indicators, time of appearance of these symptoms may vary across the varieties.



Development stages of male date palm spathe

**3.3.3(e) Investigation on material for covering fruit-bunches of date palm**

This experiment was conducted with date palm variety Halawy and six treatments for covering fruit bunches. Covering materials included were 1. iron wire mesh, 2. non-woven grow cover (80 gsm), 3. Alkathene sheet (250 gsm), 4. sheets used for agro-shed net (90 % intensity), and 5. silpaulin sheet (fertilizer bag) and 6. unbagged treatment (control). The fruits bunches were covered at gandora stage of fruit maturity.

There was significant increase in yield of fruits per plant in response to covering material used for protecting the fruit bunches. Alkathene sheet cover was highly effective with fruit yield of 4.95 kg/bunch and 45.55 kg/palm. The quality attributes viz., weight (7.18 g), length (5.42 cm), diameter (2.80 cm), volume (7.25 cc) and pulp weight (5.44 g) of fruits were significantly improved when covered with Alkathene sheet compared to any other treatments



Alkathene Sheet

Non woven grow cover

Wire mesh

Silpaulin sheet

**3.3.4 (a) Efficacy of PGRs and chemicals to control fruit drops and sun scald in bael**

In this experiment incidences of the fruit drop and sunscald affected fruits were as high as 98.00% and 47.01% respectively while fruit retention was as low as 1.97% as observed in plants without any treatment (control). However, among the different treatments combinations, the minimum fruit drop (94.17%) and sun scald

(18.00%) as well as the highest fruit retention (5.81%) were recorded with grass mulch used for retention of soil moisture + NAA (15ppm) for fruit development + course cotton cloth for fruit cover. This treatment also improved the qualitative attributes of fruits in terms of TSS (38.50<sup>o</sup>brix), total sugar(17.12%) and ascorbic acid (21.14mg/100g) when compared with control.





Control of sunscald through mulch and fruit cover

### 3.3.4 (b) Efficacy of canopy management on growth, yield and quality of bael (Goma Yashi)

In this experiment, various pruning treatments were imposed by taking into consideration two parameters viz. plant height and annual growth extension (AGE). The highest average fruit yield (80.10kg) was recorded per plant when the plants were pruned to maintain 3m plant height + 25% AGE. This treatment resulted in significant improvement in quality parameters viz., Fruit weight (1.37kg), fruit size (15.28 x 13.52cm) and T.S.S. (38.00<sup>o</sup>brix). There was slight decrease in the fruit yield (73.00 kg) per plant, when plants were pruned to 2.5m plant height with 25% AGE. In contrast, pruning at 2.5m height +75 % AGE reduced the fruit yield drastically (59.00kg) under rainfed semi-arid condition (fig. 33).

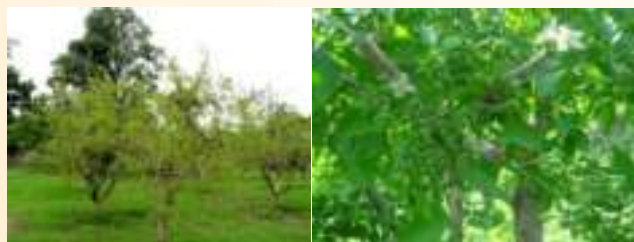


Fig. 33. Pruning treatment (3 m and pruned at 25 %

### 3.3.4(d) Effect of mulch, manure and fertilizer on fruit yield of bael

A field trail was conducted with combinations of treatments i.e., mulch, biofertilizer and inorganic fertilizers. Maximum, plant height (4.75m) was recorded in standard dose of NPK followed by grass mulch + FYM + neem cake + 50% recommended dose of NPK + *Azotobactor* + VAM culture; followed by grass mulch + FYM + 25% recommended dose of NPK + *Azotobactor* +

PSB culture; and it was recorded minimum in FYM (@20kg/ plant, whereas plant spread (4.27m), stem girth (31.60) and fruit retention (24.75 fruits/plant) was also recorded the maximum with grass mulch + FYM + neem cake + 50% recommended dose of NPK + *Azotobactor* + VAM culture under rainfed semi-arid conditions. Fruit retention was recorded minimum in control (13.17fruits/plant). Results of study revealed no significant differences for fruit weight and size.

### 3.3.5 (a) Induction of off-season fruiting in sweet orange cv. Jaffa

Experiments were conducted to assess the feasibility of growing sweet orange cv. Jaffa during off-season (summer) under micro-irrigated hot and arid climatic conditions of western Rajasthan. Photosynthesis, transpiration, stomatal conductance, canopy temperature depression, water use efficiency, membrane stability index, and relative water content were all found to be 37 times higher in normal season plants than in off-season fruiting plant. In addition, plants growing in the off-season were found to have higher levels of total phenol, antioxidants, and malondialdehyde, while plants growing in the normal season had higher levels of proline and total chlorophyll contents. Hence, it is suggested that the off-season fruiting of sweet oranges should not be recommended as it may result in poor fruit yield, low juice content and quality, high sunscald risk, thick rind and negative effects on plant health.

### 3.3.6 Nutrient management in chironji, custard apple, jamun and tamarind

Experiments conducted at regional station of CIAH at Vejapur revealed that supplementation

of plant nutrients in the form of inorganic and organic formulations along with bio fertilizers can lead to better growth and development of chironji, custard apple, jamun and tamarind under semi-arid environments.

**Chironji (9 Years age):** Maximum height (537 cm), spread (NS-465 cm & EW 476 cm), girth (67 cm) and yield (10.5 kg/tree) were observed in the treatment with NPK @150 ppm of which 50% N in organic form through bio fertilizers. Minimum plant height (460 cm) and spread (NS 380 cm & EW 361 cm) were observed in control.

**Custard apple (1Year age):** The highest values for plant height (106 cm) and spread (NS 79 cm & EW 77 cm) were observed in the treatment with NPK @100 ppm of which 50% N in organic form through bio fertilizers. Minimum plant height (40 cm) and spread (NS 35 cm & EW 30 cm) were observed in control.

**Jamun (6 Years age):** The highest values for plant height (416 cm), spread (NS 430 cm & EW 442 cm) and girth (55 cm) were observed in the treatment with NPK @ 150 ppm of which 50% N was applied in organic form through bio fertilizers. Minimum

plant height (355 cm) and spread (NS 385 cm & EW 490 cm) were observed in control.

**Tamarind (9 Years age):** The highest values for plant height (630 cm), spread (NS- 714 cm & EW 850 cm), girth (75.5 cm) and yield (12.5 kg/tree) were observed in the treatment applied with NPK @150 ppm of which 50% N was applied in organic form through bio fertilizers. Minimum plant height (525 cm) and spread (NS 643 cm & EW 649 cm) were observed in control.

### **Nutrient content of fallen leaves of different horticultural trees to predict nutrient status of the corresponding soil :**

The dried fallen leaves of trees of CHES, Vejalpur farm were analyzed and their nutrients were expressed in percentage on dry weight (table 12). Maximum calcium (6.49%) in sweet orange, maximum magnesium (1.25 %) in bael, maximum potassium (1.19%) in wood apple maximum sodium (0.42%) in tamarind were observed among the different types of orchard trees. Based on the nutrient content of fallen leaves also we can judge the nutrient supplying power of different soils in different climatic regions.

Table 12. Nutrient composition of dried fallen leaves of different trees on dry weight basis

Tree Name	Calcium (%)	Magnesium (%)	Potassium (%)	Sodium (%)
Aonla	1.48	0.39	0.31	0.13
Bael	5.25	1.25	0.15	0.10
Chironji	2.67	0.19	0.20	0.08
Custard Apple	4.97	0.62	0.36	0.07
Guava	2.75	0.38	0.29	0.15
Jamun	1.71	0.93	0.29	0.11
Mango	3.48	0.19	0.18	0.09
Manila Tamarind	3.29	0.86	0.24	0.18
Tamarind	3.48	1.12	0.43	0.42
Sapota	2.26	0.85	0.14	0.19
Sweet Orange	6.49	0.45	0.43	0.20
Wood Apple	3.61	0.55	1.19	0.15

### **3.3.7 Development of protocols for organic and natural farming in fruit crops to enhance sustainability**

Different organic products (panchagavya, agniastra, ghan jiwamrita, jiwamrita, CIAH formulation-1 & CIAH formulation-2) were prepared for nutrient management as well as disease and insect- pest management in horticulture crops. Already reported formulation were prepared as per

standard protocols while two novel formulations i.e., CIAH-1 and CIAH-2 were prepared with addition of extracts derived from locally available flora. These formulations were tried on aonla crop and application of these formulations remarkably improved fruit quality parameters when compared with control without any of these treatments (fig 34).

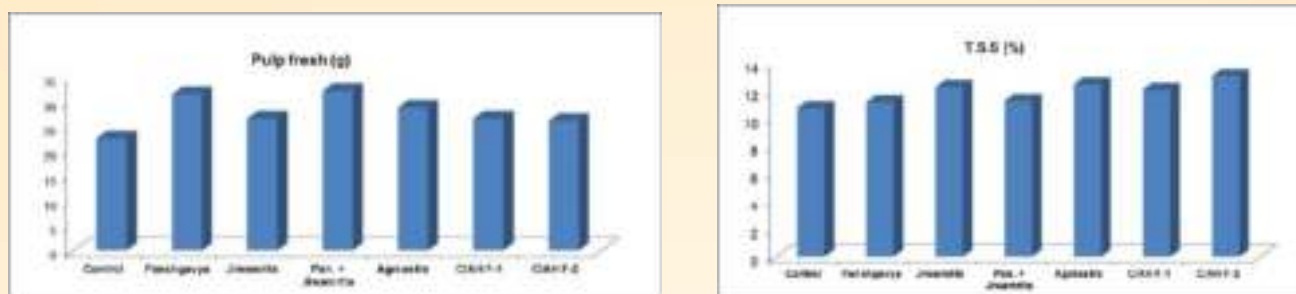


Fig. 34. Effect of different organic formulations on fruit quality of aonla fruits

### 3.3.8 Germination studies in ker (*Capparis decidua* (Forsk.) Edgew)

An experiment was conducted to standardize sexual propagation in ker. The experiment was carried out with 24 treatment combinations comprising 3 levels of GA<sub>3</sub> (G<sub>0</sub>-control; G<sub>1</sub>- GA<sub>3</sub>-100 ppm; G<sub>2</sub>-GA<sub>3</sub>-200 ppm), 2 levels of treatment duration (D<sub>1</sub>- 24 hr; D<sub>2</sub>- 48 hr); 2 levels of seed size (S<sub>1</sub>-small - < 2.5 g; S<sub>2</sub>-bold - > 2.5 g) and 2 levels of media (M<sub>1</sub>-soilless, M<sub>2</sub>- soil) along with absolute control. The observation on germination and the time taken for germination revealed that soaking of ker seed for 24 hr. in plain water is sufficient to achieve optimal seed germination (89%). However, the use of GA could accelerate the seed germination and substantially shortens the germination period. However, media considerably affected the time required for seed

germination as well as seed germination percentage. Germination of seeds were better in soilless media than in soil.

### 3.3.9 Khejri based natural farming studies

The seedlings of native crop-plant species such as ker, jharber, rohida, lasora, kumat and khejri were observed as inter-crop / boundary side plantations, and studied with HBCPSMA concept to promote desert horticulture under rainfed and natural production situations. Jharber seedling population were studied for fruit taste, size, edible portion, bearing time and dehydration suitability. Five plants found elite with respect to taste, size, edible portion and dehydration value out of 164 seedlings population. In addition, Goondi (*Cordia gharaf*) seedlings were established with khejri production system as a new climate resilient crop.



Harvested fruits Jharber



Fruit bearing of Jharber



Jharber orchard

### 3.3. 10 Standardisation of seed germination method in drumstick variety Thar Harsha

The seed without wing kept in between paper (rolled towel method-BP) produce healthy and vigorous seedling with highest germination (66 %) followed by Seed with wing-BP (48 %) while, the lowest germination (22 %) was found in seed without wing-TP followed by Seed with wing-TP (42 %) with poor seedling growth. The parameters recorded during the study are germination % at 4, 6, 8, 10, 12 and 14 DAS of the seed, healthy

seedlings ready for transplanting, seedling length, stem diameter, stem length, seedling spread (E-W/N-S), leaf length, leaf number, leaflet number per leaf at 45 DAS to know the interaction effect of different substrates on morphological parameters.

### 3.3. 11 Muskmelon genotype under tunnel and open field environment

Eleven muskmelon genotypes were sown under two set of production environment s(tunnel and open condition). The crop of the first set of

experiment under polythene covering/tunnel was sown on 07.01.2022 and the crop of second set of experiment under open field condition was sown on 16.02.2022. Both sets of experiment were raised under drip system of crop cultivation. From the initial observations, it was found that the crop raised under tunnel was ready for first marketable fruit harvest during the first week of April, whereas the crop raised under open field attained harvestable maturity during third or fourth week of April. Based on evaluation of germplasm under both the environment, the germplasm viz. CIAH-1, AHMM-26, AHMM-46, CHES-238, AHMM-20 were found to be promising with early maturity and desired fruit quality attributes and hence have been shortlisted for further evaluation and generation advancement.

**3.3.12 Optimisation of saline water use for cultivation of cucurbits and radish under arid conditions**

A series of field experiments were conducted with the objective to investigate the effect of saline water with different combination of organic / inorganic fertilizers as amendments under arid environment. As expected, the salinity level of

irrigation water significantly affected the crop growth, yield and fruit quality of cucurbits. However, the adverse effect could be reduced by some of the amendments as briefly mentioned in the following section

Growth and fruit yield of ridge gourd (*Luffa acutangula* L.) cv. Thar karni was significantly high only when the EC was as low as 0.5 dSm-1 and fertilizers were supplied both in organic (50%) and inorganic (50%) form. In contrast, the vegetative growth and yield of Radish (*Raphanus sativus* L.) cv. Pusa Desi was relatively high even when the salinity of irrigation water was as high as 4EC if supplemented with 100% NPK+ FYM. However, root quality in this treatment was not as good as that was observed with 0.5EC (IW)+ 100 % NPK+FYM. Snapmelon (*Cucumis melo* var. *momordica*) cv. AHS-82 could perform well with irrigation water @ 4 EC +FYM @15ton/ha under arid region. However, in case of Kachri (*Cucumis callosus*) cv. AHK-119 : Combination of FYM and vermicopost with 4EC saline water could enhance fruit yield. But, fruit quality registered with this treatment was not as good as that obtained with irrigation water @.5 EC+FYM @ 15 ton/ha (fig 35, 36 & 37).

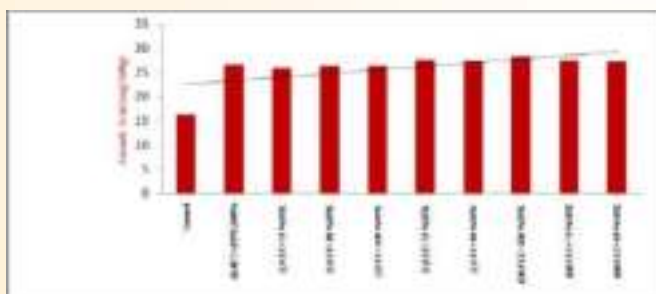


Fig. 35. Ascorbic acid content of radish roots affected by saline water and fertilizer doses



Fig. 36. Snapmelon under saline water irrigation



Fig. 37. Performance of Radish under saline water irrigation

### 3.4 Plant protection:

#### 3.4.1 Survey of pomegranate growing areas for occurrence of nematode

A survey programme of pomegranate (variety 'Bhagwa') orchards was conducted at Rajoriya Krishi Farm (near Adsar village), Dungargarh Tehsil and Rashmi Krishi Farm as well as Jain Krishi Farm at Kanasar village of Bikaner Tehsil of Bikaner district for occurrence of

nematode incidence. We interacted with farmers regarding total number of plants, fruit yield and fruit colour. Nematode incidence was ranged from 1.33 to 12.67% with symptoms like no flowering and little leaf in infected plants. Further, root system was manifested by retarded growth and falling of mature plants, however, plants propagated with tissue culture were free from the root not nematode infection (fig. 38).



Fig.38. Nematode infected pomegranate plants

#### 3.4.2 Screening of date palm germplasm for tolerance against *Alternaria* leaf spot

*Alternaria* leaf spot disease was appeared in mild to moderate form during reported period under field conditions at this Institute. Forty-two date palm germplasm were screened for tolerance against *Alternaria* leaf spot under natural conditions at date palm germplasm block of this Institute. Symptoms were observed as small light, circular and dark gray to black spots. Later on, these spots expanded, became irregular and black to straw colored and coalesced. Disease incidence (PDI) was ranged from 0.0-30.68%. Minimum disease incidence (0.0-2.52%) was recorded in date palm variety Braim, Samran, Hatemi, Saidy and Javantri but maximum disease incidence (6.43-30.68%) was found in date palm variety 'Medzool' under field conditions.

#### 3.4.3 Occurrence of virus and virus like pathogens

In hot arid ecosystem diverse array of virus and virus like symptoms were observed on cucurbits and solanaceous crops. The symptoms included yellowing, mosaic type, growth stunting, necrosis, etc. (fig. 39).



Fig. 39. Virus symptoms observed on Water melon, chilli and cluster bean

### 3.5 Post-harvest management:

#### 3.5.1 Evaluation of ber genotypes for Shelf life at ambient condition

Twenty seven germplasm of ber were evaluated for shelf life at ambient storage condition. Among the germplasm physiological loss in fruit weight was as high as 14.19 & 47.52 % in Thai and as low as 0.42 & 15% in Tikadi during 5<sup>th</sup> and 10<sup>th</sup> day of storage, respectively. With regards to dry matter content germplasm Goma Kirti, Umran and Chuhara recorded more than 33 per cent in contrast

to Thai (11.10%). Dried fruits of ber germplasm retained colour shades from purple group (N77) to grey purple (N187). Shelf life of Goma Kirti, Safesa Rohtak, Safeda Selection, Tikadi, Umran

and ZG-3 better (5 days) than that of Gola, Kala Gola, Banarsi Pewandi ber varieties (2 days) (fig. 40).

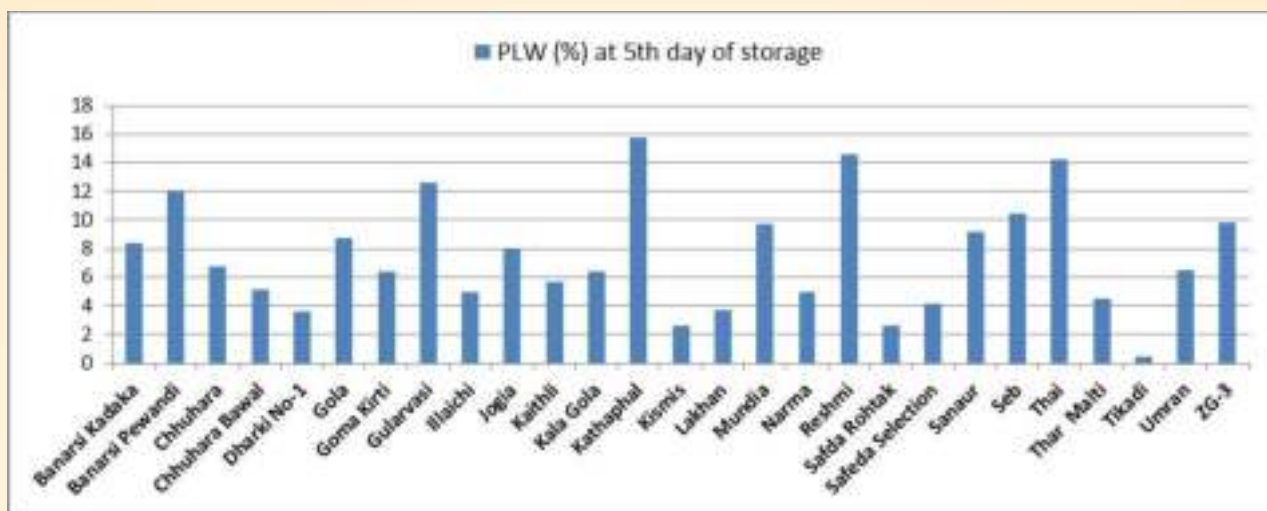


Fig. 40. Physiological loss in weight (PLW) of ber genotypes

**3.5.2 Designing and fabrication of low cost drying structures for on-farm drying of arid fruits and vegetables**

ICAR-CIAH, Bikaner designed and fabricated low cost drying structures (tunnel type & vertical dryer), which are more efficient, hygienic and can prevent insects, rodents and other animals.

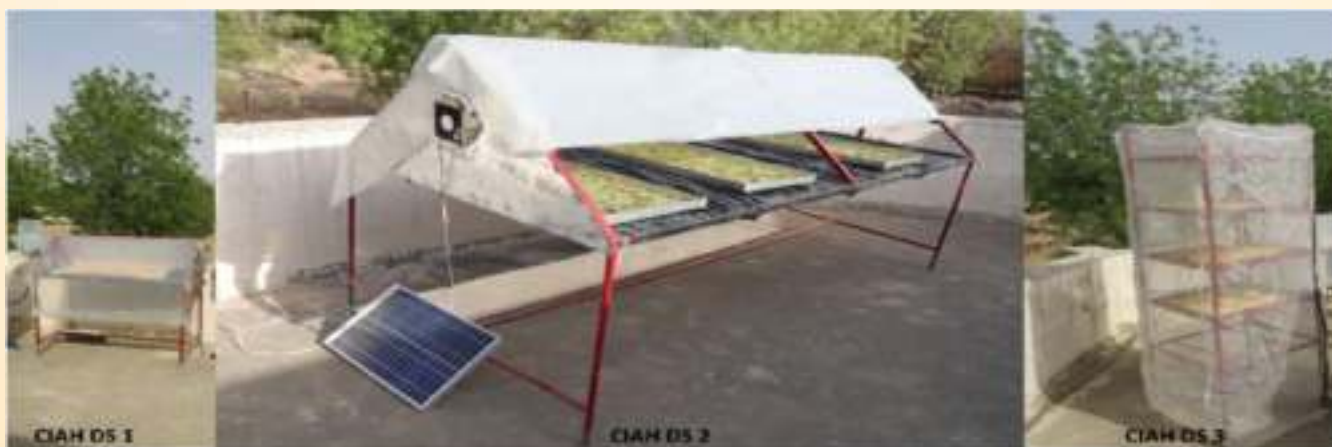
**Tunnel type portable dryer:**

Institute has designed and fabricated two different tunnel type drying structures which have drying capacity for 5 kg (CIAH DS 1) and 25 kg (CIAH DS 2) of fresh produce. The dimensions of CIAH DS 1 are 120 cm length, 60 cm width, 70 cm height from ground surface and fitted with 12 volt DC exhaust fan. This structure is suitable for domestic use in urban areas. The dimensions of CIAH DS 2 are 260 cm length, 120 cm width and 45 cm tunnel height and 70 cm height from ground

surface. This structure is fitted with 48 volt DC exhaust fan operated by solar panel. It is suitable for commercial use for drying of arid fruits and vegetables. This drying structure can be replicated at farmer's field for on-farm drying and also dimensions can be customised for to cater to the need of farmer.

**Vertical drying structures:**

For on-farm drying of arid fruits and vegetables, vertical portable structures (CIAH DS 3) are designed and fabricated. It can accommodate 5 trays. The structure dimensions are 180 cm height, 60 cm width and size of each tray is 60x60 cm<sup>2</sup>. Drying structure is covered by insect proof net to protect produce from insects, rodents and birds. This structure is naturally ventilated and there is no requirement for external energy to make uninterrupted air movement.



Low cost drying structures for on-farm value addition

### 3.5.3 Standardization of *Thar Shobha Khejri* maturity indices

Tender pods of specific maturity stage are required for getting good quality dehydrated sangria, the consumable fruits of Khejri. Therefore to identify ideal harvesting stage, maturity indices were standardized for variety *Thar Shobha*. Pods were harvested at 3 days interval *i.e.* 10, 13, 16, 19

and 22 days after pod setting then blanched, dehydrated before estimating cooking parameters and sensory attributes. It was observed that the 1.0-2.5 mm pod thickness and deep green to green colour of pods that were harvested 10 to 16 days after pod setting could serve as reliable maturity indices for sangri harvesting in *Thar Shobha Khejri* (fig 41).

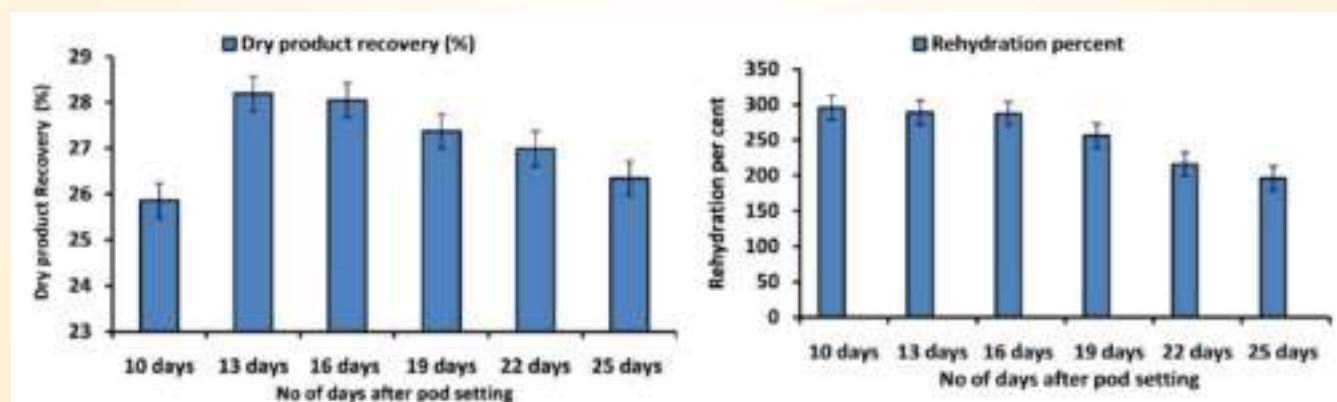
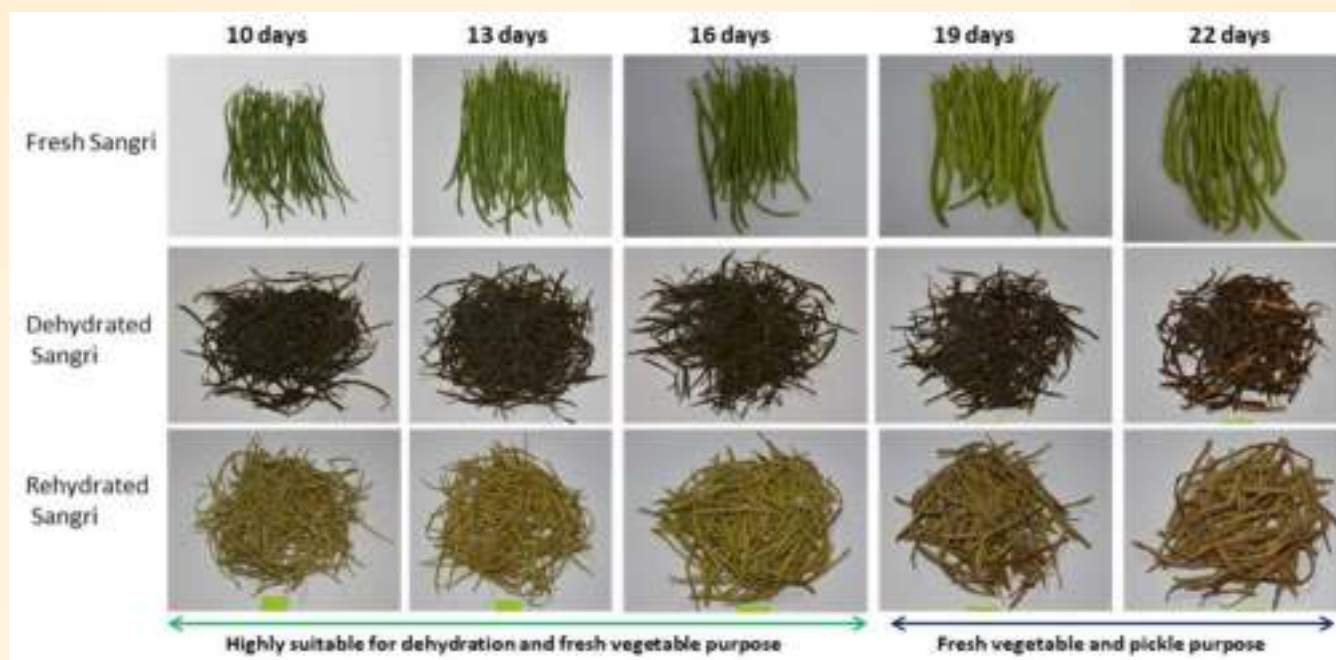


Fig. 41. Dry product recovery and rehydration per cent of dry sangri harvested at different maturity stages

### 3.5.4 Post-harvest handling, processing and packaging of sangri

**Harvesting:** Tender green pods (sangri) are harvested between 10-18 days after pod setting. For good quality pods three pickings at 3 days interval are required during 2<sup>nd</sup> fortnight of April month. Pods are harvested manually by picking bunches or individual pods.

**Sorting and Grading:** Under-size and over

matured pods are separated from the tender pods.

**Blanching:** Green pods were blanched in boiling water for 5 minutes period. After blanching, pods were immediately dipped in cold water for 5 minute's period to prevent over cooking. The pods were removed from water and spread on clean cloth or aluminum/steel tray.

**Drying:** Blanched pods are dehydrated in open sun light or dryer/ dehydrator. In solar dryer (CIAH DS-

2), sangri is dried in 8 hours and retained better color and good sensory properties while in open sun 24 hours time required for drying.

**Packaging and labeling:** Dried sangri was packed in food grade standee pouches and plastic boxes of 100, 200, 250, 500 and 1000 gram capacity. Then

labels were pasted on sangri packages, which include information regarding quality, nutritional value, method of consumption, storage information etc. During marketing, package of 250 gram capacity was found most suitable for retail marketing directly to consumer as family pack.



Post harvest handling, processing and packaging of sangri

**3.5.5 Protocol standardized for extraction and preservation of Snap Melon pulp**

Snap Melon (*Cucumis melo* var. *momordica*) crop is mainly consumed in salad, chaat, fresh vegetable, and juices and also preserved in dehydrated form for off season consumption. Seed kernels are utilized in sweets, bakery confectionery preparations and in popular traditional drink *Thandai*. Phoot ki chaat is a widespread recipe found in Rajasthan during summers. Snap melon is the rich source of beta carotene, folic acid, fiber, potassium and ascorbic acid. It is excellent for the health of kidneys and liver too. Its juice has cooling effect and consumed in southern states during scorching heat.

Snap melon fruits should be harvested at fully mature stage for pulp extraction. A thin layer of peel is removed and fruits are cut in four vertical slices. The seeds and placenta removed from slices. Slices are cooked in boiling water for 30-35 minutes. Cooked slices are removed and then cooled. After that, pulping is done by passing of slices through pulper or in mixer grinder. After pulping, pulp is sterilized at 95 °C for 5 minutes, and then cooled. Preservative is added after cooling and pulp is filled in air tight food grade containers for long term storage. The stored pulp can be used for preparation of various value added products like chutney, jam and ketchup.





### 3.6 Extension and outreach activities

#### Impact assessment of adoption of pomegranate and date palm crops in hot arid regions of Rajasthan

Requisite information were collected through both online and off mode from the pomegranate growing districts of the hot arid zone of Rajasthan under this project to generate data from primary and secondary sources including respondents (farmers/stakeholders) and repositories of records/reports. The salient findings from this exercise is as follows.

1. At present the area under date palm is relatively high in Bikaner district (340 ha) followed by Jaisalmer (215ha), Sriganganagar (193 ha), Barmer (161 ha) and Hanumangarh (147 ha) as compared to other date palm growing districts such as Sikar and Jhunjhunu.
2. The area under pomegranate was the highest in Barmer district (7810 ha) followed by Jalore (3190 ha), Bikaner (1626 ha), Jodhpur (390 ha), Jaisalmer (472 ha) and Pali (3010) while it was substantially less in district like Churu, Sikar, Sri Ganganagar and Nagaur. The trend of production was almost same.

In addition to above, study carried out revealed the information on socio-economic impact of adoption of improved production technologies of pomegranate as well as date palm and factors responsible for adoption and discontinuance of the production.

#### (a) Economic impact of adoption pomegranate.

1. Cost of establishment of orchard per ha ranged from Rs. 1.33 - 1.48 Lakhs
2. Total cost of cultivation (per ha/year) was ranged from Rs. 1.36 - 1.85 Lakhs (up to fruiting)

3. Total yield (per ha) fluctuated between 3.3 - 7.2 tons from 4 - 8 years old orchards.
4. Selling price of quality fresh fruits of pomegranate fluctuated between Rs 40 - 72 per kg (4000 - 7200 per qtls).
5. The income from one ha of pomegranate orchard could be extrapolated as Rs 132000 based on the productivity and the prevailing price.

#### (b) Economic impact of adoption date palm.

1. Cost of establishment of orchard of operated per ha ranged Rs. 1.2 to 1.32 Lakhs
2. Total cost of cultivation (per ha/year) ranged Rs. 1.4 to 2.37 Lakhs (up to fruiting)
3. Total yield (per ha) fluctuated/ranged 5.7 to 7.5 tons (10-12 years old orchards)
4. Selling price of quality fresh date fruits fluctuated between 35 - 60 per kg (35000 - 60,000 per qtls.).
5. The income from 1 ha orchard could be of Rs 213000 per ha per year from 10 to 12 year old plot.

#### (c) Impact in terms of social changes

1. Increasing inclination towards entrepreneurship.
2. Close interaction and intimacy among the farmers increased to exchange inputs/knowledge for adoption of date palm and pomegranate crops on their field.
3. Increase in the commodity interest groups in social system.
4. Increase in the cosmopolitan attitude and scientific orientation of the farmers.
5. The windfall profit (advantage earned by first adopter) farmers were also increasing in the field of horticulture in hot arid regions of western Rajasthan.

#### 4. EXTERNALLY FUNDED PROJECTS

**Project: Enhancing Food and Water Security in Arid Region through Improved Understanding of Quantity, Quality and Management of Blue, Green and Grey Water**

(Activity: Conjunctive use of surface and ground water resources in arid horticultural crops)

Funding Agency- Department of Science & Technology, New Delhi.

The maximum fruit yield/plant (9.78 kg) was observed when EC of irrigation water was as low as  $0.75 \text{ dSm}^{-1}$ . The fruit yield was reduced to 9.24 kg/plant when the EC of water was  $1.75 \text{ dSm}^{-1}$ , however, the reduction was not significant. In contrast, a drastic increase in salinity ( $6.00 \text{ dSm}^{-1}$ ) reduced the fruit yield significantly. Nevertheless, it was possible to get as much as fruit yield of 7.19 kg/plant despite increase in salinity. The reduction in fruit yield could be attributed to reduction in the canopy development, number of fruits per plant and fruit weight. It was also observed that saline water with EC of  $6.00 \text{ dSm}^{-1}$  could enhance the fruit cracking (16.67%) while the lowest fruit cracking (10.50%) was observed at  $0.75 \text{ dSm}^{-1}$ .

**Project: DUS Centre (Watermelon and Muskmelon)**

Funding agency- PPV & FRA, New Delhi

During the year, conducted DUS testing of four entries of watermelon (WM 20-1 F<sub>1</sub> SMG Hybrid, WM 20-1 Candidate Hybrid, WM 20-2 F<sub>1</sub> SMG Hybrid, WM 20-2 Candidate Hybrid) and four entries of muskmelon (MM 22 H<sub>1</sub> Hybrid, MM 22

H<sub>2</sub> Hybrid, MM 22 H<sub>3</sub> Hybrid, MM 22 H<sub>4</sub> Hybrid) were evaluated for DUS testing. The monitoring of crop was carried out on 26 April, 2022. Maintenance breeding of watermelon and muskmelon was done to provide the reference varieties for DUS testing of new, VCK and farmer's variety.

**Project: DUS- Ber**

Funding agency- PPV & FRA, New Delhi

Twenty one new ber genotypes were characterized as per DUS guidelines with the objective to compare a wide range of *Zizyphus* material. The reference ber varieties (25) and test varieties (85) were evaluated for flowering pattern, fruit set pattern as well as frost injury levels.

**Project: DUS Centre on Date palm**

Funding agency- PPV & FRA, New Delhi

Under DUS program on date palm, data on morphological and fruit characters in reference varieties were recorded as per DUS guidelines. The spathe emergence/flowering/fruitletting were recorded in 38 varieties during 2022. Early emergence of spathe/opening in male palms in comparison to female was also observed. Early flowering/fruitletting and maturity were noted in cv. Dhamas Nagal and Surya. Variation in fruit weight, size, shape, and stone weight were observed. Fruit yield varied from 5.0 to 60 kg/plant at *doka* stage. Medjool, Sabiah, Dayari and Siwi cultivars were harvested late at the end of July and beginning of August. The reference varieties were maintained at the centre.



**Project: Validation of DUS descriptor for bael**

Funding agency- PPV & FRA, New Delhi

Reference varieties, viz., Goma Yashi, Thar Divya, Thar Neelkanth, Thar Srishti, NB-5, NB-7, NB-9, NB-16, NB-17, Pant Aparna, Pant Sujata, Pant Shivani, Pant Urvashi, CISH-B-1 and CISH-B-2 are being maintained at the Station to characterize the farmer's varieties. Farmers varieties of Chhatishgarh, West Bengal and Bihar are being studied for DUS characters.

**Project: Characterization of aonla varieties for developing DUS testing guidelines (Co-nodal centre)**

Funding agency- PPV & FRA, New Delhi

Reference varieties, viz., NA-7, NA-6, Banarasi, Chakaiya, Francis, Anand-1, Anand-2, NA-4, Goma Aishwarya, NA-10 and NA-5 are being maintained at the Station to characterize the farmer's varieties.

**Project: Development of morphological descriptors and DUS test guide lines for jamun, Co Nodal centre**

Funding agency- PPV & FRA, New Delhi

Morphological descriptors and DUS test guide lines for jamun have been developed and submitted to the Authority. Varieties are being maintained at the station.

**Project: DUS nodal centre for Chironji and tamarind**

Funding agency- PPV & FRA, New Delhi

Morphological descriptors and DUS test guide lines for chironji and tamarind have been developed and submitted to the Authority. Varieties are being maintained at the station.

**Project: Farmers First Programme: Diversified Farming through Livestock and Agriculture (Collaborative project with ICAR-CIRB, Hisar)**

Funding Agency: ICAR (SMD Extension

Education), New Delhi

Under this program, the institute celebrated the Kisaan Diwas at farmers field at Ninan Village of Hanumangarh District and almost 50 farmers has participated, Distributed the vegetable seeds of Improved varieties of ICAR-CIAH viz. Kachari (AHK-119), snap melon (AHS 82), Long melon (Thar Sheetal) and Brinjal (Thar Rachit) to the farmers. Procured about 6000 plants of Khejri (Thar Sobha), karonda (Thar Kamal), jamun, phalsa and lasoda from ICAR-CIAH Bikaner for distribution to the farmers of selected villages near Hisar Area. Published two Books/ Extension material (In hindi) Named "Nutri Farm" and "Phal-Phool".

**Project: Production of quality planting material of Khejri (2022-23 to 2024-25)**

Funding agency- NABARD, regional centre, Jaipur (Raj.)

In this project a review meeting was conducted on 26 November, 2022 under chairmanship of Dr. D.K.Samadia and Sh. B.N. Kurup, CGM, NABARD regional centre Jaipur and work of planting material production of khejri was allotted to firm through job contract.

**Project: Post-Entry Quarantine Facility for Date Palm.**

Funding agency- MIDH, Division, Krishi Bhawan, DA&FW, MA&FW, New Delhi

Post entry quarantine facilities initiated and all civil works allotted to CPWD and as per blue print work has been initiated accordingly.

**Project: Development of hi-tech horticulture nursery with water harvesting structure**

Funding agency- RKVY, New Delhi

Under this project strengthen existing nursery structures and development of need based infrastructure along with renovate/ improve harvesting structures in horticulture research farm/ nursery for production of quality planting material of horticultural crops.

## 5 (a). TRANSFER OF TECHNOLOGY

### Events Organized

- Organized "PM Kisan Samman Nidhi Fund Programme" in virtual mode at the Institute on 01.01.2022 during which several farmers were called/interacted in virtual mode.
- Celebrated National Girl Child Day on 24.01.2022 in Library-cum Video Conferencing Hall of the Institute in which girls of the staff colony and others participated.
- Organized " Regional Awareness Campaign on Natural and organic farming of arid horticultural crop under *Bharat Ki Ajadi Ka Amrit Mahotsva* at the Institute from 01.02.2022 to 08.02.2022 in virtual mode (online).
- Organized arid region vegetable seed sale day on 09.02.2022 at ICAR-CIAH, Bikaner in which seeds of various vegetables (Palak, Bottle gourd, Kachri, Sponge gourd, Snap melon, Cluster bean, Brinjal, Ridge gourd, long melon) was distributed.
- Celebrated "World Pulses Day" at the ICAR-CIAH, Bikaner on 10.02.2022
- Celebrated "National Science Day" on 28.02.2022 at Shanskar Bal Bharati Sec. School, Bichwal Bikaner in which more than 100 students/teacher participated and the Scientists/ technical of the Institute delivered the lecture on different relevant topics during the programme.
- Celebrated International Women Day" on 08.03.2022.

- Mega National Campaign on "*Kisan Bhagidari, Prathamikta Hamari*" under the programme *Azadi Ka Amrit Mahotsava*, Government of India was organized during 25.04.2022 to 30.04.2022.
- Celebrated 8<sup>th</sup> National Handloom Day on 7<sup>th</sup> August, 2022 and a campaign was organized during which different workers/shop keepers of Indian Handloom Fabrics and handloom weavers and related persons were contacted in Bikaner city and motivated for working on handloom fabrics.
- Ghar Ghar Tiranga Campaign*: Meeting, discussion and distribution of National flag (*Tiranga Jhanda*) among the all employees/staff of the Institute (including scientists, administrative staff, Audit & account staff, technical staff, RA, SRF, YPs, etc) urged them for participation in celebration programme of "Azadi Ka Amrit Mahotsav- Ghar Ghar Tiranga Campaign" from 13.08.2022 to 15.08.2022. The "Azadi Ka Amrit Mahotsav- Ghar Ghar Tiranga Campaign" was also carried out in different local villages/areas, schools and several farmers/people/students/teachers were provided with National Flag (*Tiranga Jhanda*) to hoist the it on their home and also encouraged with support taking leadership during the period of from 13<sup>th</sup> - 15<sup>th</sup> August, 2022 to make the "Har Ghar Tiranga" campaign for grand success in rural areas/villages too.



Ghar Ghar Tiranga Campaign

- Observed "Parthenium Awareness Week " from 16 - 22 Aug., 2022. During this week various programmes and activities were held/organized to create to general public awareness and knowledge among the staff, general public,

farmers, students, etc., about the ill effect of Parthenium on human and animal health, environment, crop production and productivity and biodiversity. During the this week", the special programme/lectures/meetings/ were

also arranged for villagers/ farmers in local villages/on farmers' fields to teach them about the ill effects and its control measures of the Parthtenium.

- ⌚ Organized "Cyber Jaagroota Divas Annual Day Celebration" programme at the Institute on 06.10.2022.
- ⌚ Organized "Hindi Pakhawada" programmes

from 14.09.2022 to 30.09.2022.

- ⌚ Institute has participated in National Sammelan on "Ozone layer, its depletion and impact on living being (ODIL-2022),] and institute's technologies was exhibited at NRCC Bikaner on 16.09.2022.
- ⌚ 30<sup>th</sup> Foundation Day of the Institute was celebrated on 01.10.2022.



Field visit and interaction of Dr. O. P. Pareek (founder Director, ICAR-CIAH, Bikaner) with scientists on foundation day of the institute

- ⌚ Celebrated anti-corruption week in the institute during which, organized the programme on creating awareness about the corruption and vigilance among the students in Shankar Bal Bharati School, Bicchwal Bikaner on 02.11.2022.
- ⌚ Celebrated world soil day at Salasar village, Bikaner on 05.12.2022.
- ⌚ Kisan Diwas was celebrated at Meghasar village on 23.12.2020. In this programme more than 200 farmers/ students, Gram Pamchayat officials, members of civil society, etc.,

participated in this programme.



Farmers' Day celebration among farmers

**Field days organized at KVK, Panchmahal**

S. No.	Title	Duration	Venue/place	No. of participants
1.	Summer okra cultivation	23.04.2022	Athaman	16
2.	Goat farming	31.05.2022	Kharsalia	27
3.	Maize cultivation	23.09.2022	Nesad	24
4.	Scientific Vegetable Nursery management	27.08.2022	Bedhiya	22

### Swachchh Bharat Abhiyan

As per directions from Government of India and ICAR, New Delhi, the cleaning work under *Swachchhata Abhiyan* was organized time to



time inside and outside the institute's campus. The awareness and knowledge about *Swachchhata Abhiyan* were also created among the students, farmers and masses during the reported period.



Activities organized during *Swachchh Bharat Abhiyan*

### AICRP-AZF Workshop

The institute has organized annual group meet of research workers of all india Coordinated Research Project on arid Zone Fruits in collaboration with ANDUAT, Ayodhya. In this workshop 18 different centres of SAUs and ICAR institutes were participated and presented their annual progress report.

### Trainings Organized

A five days collaborative online training programme between ICAR-CIAH, Bikaner and MANAGE, Hyderabad on “Extension Strategies for Promotion of Climate Resilient Horticultural Technologies in Hot Arid and Semi-arid regions” was organized during 11.10.2022 to 15.10.2022



A five days collaborative online training programme between ICAR-CIAH, Bikaner and MANAGE, Hyderabad on “Extension Strategies for Promotion of Climate Resilient Horticultural Technologies in Hot Arid and Semi-arid regions”

- An eight days programme/training (ONLINE) during the "Regional Awareness Campaign on Natural and organic farming of arid horticultural crop under *Ajadi Ka Amrit Mahotsva* at the Institute from 01.02.2022 to 08.02.2022.
- Organized 05 days farmers training programme at the Institute on "Improved production technologies of arid horticultural crops" in collaboration of ATMA, Jhunjhunu district of Rajasthan during 21.03.2022 to 25.03.2022 at ICAR-CIAH, Bikaner.
- Organized one day farmers' training programme on " Natural Farming" on the occasion of Mega Campaign held "ANNADATA DEVO BHAVA" under the programme *Azadi Ka Amrit Mahotsava*, Government of India in virtual (online) at Himtasar village of Bikaner district on 24.04.2022.
- Conducted one day farmers' training programme while conducting FLDs of Kachri (AHK-119) sponge gourd (Thar Tapis), ridge gourd (Thar Karani), snapmelon (AKS-82) and veg. clusterbean (Thar Bhadvi) on the field of Sh. Rewat Ram Kumawat S/o Sh. Hanumana Ram Kumawat, 4JMD, Khara, Bikaner on 07.07.2022.
- Organized farmers training programme at Lacchadsar village of Churu district on "commercial production of arid vegetables and postharvest management on 09.09.2022.

- Organized farmers training programme at Napasar village of Bikaner district on "Ber Based cropping system" on 19.09.2022.
- Organized farmers training programme at Sinthal (Belasar) village of Bikaner district on "Ber Based cropping system" on 20.09.2022..



Training Programme on Arid Horticulture Production Technologies

### Training programs organized at KVK, Panchamahahal

S. No.	Training title	Duration	Venue	No. of participants
1	Soil health and fertility management	16.2.2022	KVK, Panchamahahal	21
2	Cultivation of Summer Groundnut	28.2.2022	KVK, Panchamahahal	23
3	Cultivation of Summer Green Gram	24.3.2022	Kakani Muvadi Derol	20
4	Cultivation of Summer Sesamum	20.4.2022	Bedhiya	19
5	Integrated Nutrient management in Pigeon pea and Soybean	25.5.2022	Parvadi	25
6	Integrated water management	30.6.2022	Wachhavad	23
7	Micro nutrient deficiency in crops	22.7.2022	KVK, Panchamahahal	18
8	Bio-fertilizer application in field crops	8.8.2022	KVK, Panchamahahal	23
9	Production and use of organic inputs	21.9.2022	Ratanpur Reliya	18
10	Weed Management in Rabi crops	15.11.2022	KVK, Panchamahahal	20
11	Vermi-compost production technology	23.12.2022	KVK, Panchamahahal	21
12	Cultivation of organic pomegranate	05.01.2022	Village-Chathi,	26
13	Organic chilli production	06.01.2022	Village-Rameshra	24
14	Organic farming	10.01.2022	Village-Parbiya,	26
15	Rejuvenation of deshi ber	18.01.2022	Kharsalia	20
16	Nutrient management in acid lime	15.02.2022	KVK, Panchamahahal	20
17	Cultivation of underutilized fruit crops	08.03.2022	KVK, Panchamahahal	20
18	Cultivation of summer okra	11.04.2022	Village-Athamna	20
19	Cultivation of off-season vegetable for more income	05.05.2022	Village-Sarangpur	21
21	Scientific cultivation of ber	22.06.2022	Village-Lilesara	20
22	Cultivation of perennial vegetables	13.07.2022	KVK, Panchamahahal	21
23	Organic vegetable cultivation	18.07.2022	Village-Wata	20
24	Scientific cultivation of solanaceous vegetable organically	28.07.2022-30.07.2022	KVK, Panchamahahal	24
25	Vegetable Nursery management	06.08.2022	KVK, Panchamahahal	19
26	Importance and scope of organic farming	06.09.2022	KVK, Panchamahahal	21
27	Nursery management of Horticultural crops	22.09.2022-25.09.2022	KVK, Panchamahahal	22
28	Cultivation of organic mango	27.09.2022	Village-Kalol	22
29	Cultivation of tomato organically	07.10.2022	Village-Lilesara	30
30	Climate resilient Agriculture	14.10.2022	KVK, Panchamahahal	21
31	Impact of climate change in agriculture	18.10.2022	KVK, Panchamahahal	15
32	Climate resilient Agriculture	19.10.2022	KVK, Panchamahahal	18
33	Natural farming	14.11.2022	Village-Bhanpura	24
34	Pest and disease management in chickpea	29.01.2022	Bodidara	21
35	Management of stored grain pest	24.02.2022	Mokal	21
36	Use of botanicals in insect pestsmanagement	03.03.2022-05.03.2022	KVK, Panchamahahal	22
37	Pest management in brinjal crop	07.04.2022	Kolwan	22
38	Role of insect traps in IPM	06.05.2022	KVK, Panchamahahal	25
39	Pest and disease management in pigeonpea	16.06.2022	Bodidara	21
40	Important pest and disease of cotton and their management through integrated approach	15.07.2022	KVK, Panchamahahal	23

41	IPM in paddy	26.08.2022	Nathpura	35
42	Training on natural farming	08.09.2022	KVK, Panchamahahal	19
43	Insect-pest and disease management in vegetable crop through bio-pesticides	27.10.2022	KVK, Panchamahahal	20
44	Pest and disease management in maize	18.11.2022	Karada	21
45	Pest management in wheat	22.12.2022	KVK, Panchamahahal	20
46	ICT tools useful for agriculture	06.01.2022	KVK, Panchamahahal	22
47	Group formation and its process	12.02.2022	Earl	25
48	I-Khedut portal	14.03.2022	KVK, Panchamahahal	22
49	PPP in agriculture	12.04.2022	Shakrtipura	23
50	Scope of Agri business in agriculture	10.05.2022	KVK, Panchamahahal	26
51	Agriculture schemes useful for farmers	07.06.2022	Nesda	21
52	ICT tools useful for agriculture	12.07.2022	KVK, Panchamahahal	23
53	Agriculture schemes useful for farmers	04.08.2022	KVK, Panchamahahal	29
54	I-Khedut portal	05.09.2022	Kharsalia	21
55	Formation of FPO and its impact	18.10.2022	KVK, Panchamahahal	23
56	Agriculture schemes useful for farmers	15.11.2022	KVK, Panchamahahal	22

### FARMERS EXPOSURE VISIT/ EDUCATIONAL TOUR/ DELEGATED

- Exposure visit of Farmers from Barmer (organized by ARC-CSWRI Bikaner) on 30.08.2022
- Exposure visit of participants of Dy. Ranger/Forester training at FTI Pinjore 2021-22 on 03.09.2022
- Exposure visit of participants of DST-SERB sponsored workshop organized by RRS-CAZRI Jodhpur on 08.09.2022
- Exposure visit cum educational tour of student visit of AAU Anand (Gujarat).
- Exposure visit cum education tour visits of graduate students of Maharaja Agrasen Agriculture College, RIICO area, Suratgarh, distt. Suratgarh on 14.12.2022.
- Exposure visit cum education tour visits of Farmers from KVK Athiasan (Nagaur) on 06.01.2023.
- Exposure visit cum education tour visits of



### Demonstration conducted

- Conducted 02 FLDs of improved variety of kachri (AHK-119) and snapmelon (AHS-82) at KVK, Chandkothi, Churu on 14.03.2022 through Dr. Aditi Gupta, SMS, Home Science (seed sent through Bhawani Shankar, Driver,

B.Sc. Students from College of Horticulture and Forestry (Rani Laxmibai Central Agricultural University, Jhanshi-284003 (Uttar Pradesh) on 31.12.2022

- Exposure visit of the farmers of Jhunjhunu under ATMA on 22-09-2022.
- Exposure visit of the farmers of Bhiwani (Haryana) under ATMA (SC) Scheme on the occasion of farmers' day (23-12-2022).
- Exposure visit of the MBA 2022-24 batch (42 students) of Institute of Agri-business Management (SKRAU), Bikaner on 22-08-2022.
- Exposure visit of the student of B.Sc. (Hons.) Ag. Part-II & III (90 students) of Shekhawati Institute, Sikar on 01-07-2022.
- Field visit of Principal Chief Commercial Manager, Northern Railway and Senior Divisional Commercial Manager, Northern Railway on 09-09-2022.

KVK, Churu on 14.03.2022).

- Conducted FLDs of improved variety of kachri (AHK-119) and snapmelon (AHS-82), ridge gourd (Thar Karani), long melon (Thar Sheetal) at the field of Sh. Bhanwar Lal (Pappu) Meghwal (Kadela) of Ambasar village



of Bikianer district on 09.03.2022.

- Conducted FLDs of Kachri (AHK-119), sponge gourd (Thar Tapis), ridge gourd (Thar Karani), snapmelon (AKS-82) and veg. clusterbean (Thar Bhadvi) on the field of Sh. Rewat Ram Kumawat S/o Sh. Hanumana Ram Kumawat, 4JMD, Khara, Bikaner on 07.07.2022.
- Conducted FLDs of Kachri (AHK-119), ridge gourd (Thar Karani) and snapmelon (AKS-82) on the field of Sh. Sita Ram Godara S/o Sh. Mohan Ram Godara, Village-Shekhasar, Teh.-Lunkaransar, Distt.-Bikaner on 12.07.2022
- Conducted FLDs of ridge gourd (Thar Karani), snapmelon (AKS-82) and Khejri (Thar Shobha-10 budded plants + 20 rootstock) and in-situ budding on the field of Sh. Mahendra Singh Shekhawat, Village-Arjunsar, The.-Lunkaransar, Distt.-Bikaner on 09.07.2022 (Sunday).



Farmers field demonstration

### Front line demonstrations (FLDs) at KVK, Panchmahal

During reporting period thirteen front line demonstrations were conducted at various farmers filed. The total area covered (112ha) and number of farmers (295). The details of these programs are given below.

#### Details of Front-line demonstrations (FLDs)

S. No.	Particular of the FLDs	Season	Name of Crops	Name of Variety	Critical Input	Area (Ha./ Unit)	No. of Farmers	Yield (qt/ha.)		Increase in yield (%)	B:C ratio
								Demo	Local		
1.	Use of HYV with INM	Kharif	Pigeonpea	GT-105	Seed	20	50	15.4	10.2	50.9	3.4
2.	Use of HYV with INM	Kharif	Castor	GCH-7	Seed	20	50	28.4	21.2	33.9	4.1
3.	Use of HYV with INM	Rabi	Gram	GG-3	seed	10	25	17.9	14.1	26.9	3.8
4.	Use of HYV with INM	summer	Groundnut	GJG-32	seed	10	25	18.9	16.1	17.4	3.1
5.	Use of HYV with INM	summer	Green gram	GAM-5	Seed	20	50	11.3	7.9	43.0	2.7
6.	Use of HYV with INM	summer	Sesamum	GT-4	Seed	10	25	5.9	4.6	28.3	2.4
7.	Use of HYV with improved practices	Kharif	Brinjal	Anand Doli	Seed	04	10	435.5	327.5	32.97	3.55
8.	Use of HYV with improved practices	Kharif	Tomato	GT-5	Seed	04	10	352.5	261.5	34.79	3.68
9.	Use of HYV with improved practices	Rabi	Fennel	AF-1	Seed	04	10	Crop is on growth stage and final results are awaited			
10.	Management of pest complex in green gram	Summer	Green gram	-	Imidacloprid 48 FS, flubendiamide 48 SC,	2.5	10	11.20	8.30	34.94	2.51
11.	Management of stem borer in paddy through pheromone traps	Kharif	Paddy	-	Pheromone traps	2.5	10	38.50	31.00	24.19	2.11
12.	Management of banded leaf and sheath blight disease of maize	Kharif	Maize	-	<i>Trichoderma viride</i>	2.5	10	32.40	25.00	29.60	2.26
13.	Management of fruit and shoot borer in brinjal	Kharif/Rabi	Brinjal	-	Emamectin benzoate 5 SG	2.5	10	247.5	196.5	25.95	3.26

#### Extension Activities organized at ICAR KVK Panchmahal during 2022

Name of activity	Numbers	No. of participants
Field Days	4	89
Days celebration	7	236
Kisan goshtis	5	152
Campaigns	2	62
Farmer scientist interactions	5	165
Workshops	2	52
Farmers meetings	7	187
Kisan melas	2	355
Exhibitions	6	852
Awareness camps	4	355
Advisory services	225	350
Telephone helpline services	825	825
Diagnostic visits	28	105
Method demonstrations	66	186
Farm visits to visitors	7	168

**Lead/oral presentation in seminar/ conference****Dr. S.K. Maheshwari**

- Oral presentation on “Occurrence of emerging major diseases in pomegranate under hot arid conditions in Rajasthan” in 2<sup>nd</sup> Indian Horticultural Summit 2022 on “Horticulture for Prosperity and Health Security” at Navsari Agricultural University, Navsari, Gujarat during 27-29<sup>th</sup> April, 2022.

**Dr. A. K. Singh**

- Delivered a lead lecture on “Prospects of genetic resources and varietal wealth of semi-arid fruit crops for prosperity and health security” in 2<sup>nd</sup> Indian Horticulture Summit-2022 organized at NAU, Navsari (Guj.) during 27-29 April 2022.
- Oral presentation on “new bael varieties for drylands” in 2<sup>nd</sup> Indian Horticulture Summit-2022 organized at NAU, Navsari (Guj.) during 27-29 April 2022

**Dr. D. S. Mishra**

- Presented Invited Lecture on “Strategies for developing High density planting in arid fruit crops for efficient use of water and nutrients” on March 26, 2022 in a Winter School on Advances in irrigation technology and nutrient management in arid horticultural crops held at SKRAU, Bikaner during March 08-28, 2022.
- Delivered an Invited Lecture on “Vermi-composting from Fruit Waste: A way for Socio-economic Upliftment”. In one day 'National Webinar on Utilization of Fruit Waste for Economic and Nutritional Security' on February 11, 2022 by ICAR-NAHEP-IG at UBKV, Cooch Behar, WB.

**Dr. Ramesh Kumar**

- Delivered lecture on “Production technology of pomegranate” in virtual webinar entitled "Production technology of date palm and pomegranate” held during 7<sup>th</sup> February, 2022 organized by Horticulture Training Institute, Uchani, Haryana.

**Dr. R.P. Meena**

- Oral presentation in the IPS 8<sup>th</sup> International Conference (hybrid mode) on “Plant Pathology: Retrospect and Prospects”. at Sri Karan Narendra Agriculture University, Jobner, Jaipur, Rajasthan, India during March 23-26, 2022.

**Dr. Anita Meena**

- Oral presentation on “Production of snapmelon (*Cucumis melo* var. *momordica*) under saline

water irrigation in hot arid region in International Conference on ICAAAS-2022 at HPU, Shimla on date 12-14 June 2022.

**Dr. L. P. Yadav**

- Oral presentation on “Antioxidants and nutritional properties of drumstick (*Moringa oleifera* L.) germplasm under arid and semi-arid regions” in 2<sup>nd</sup> Indian Horticulture Summit-2022 organized at NAU, Navsari (Guj.) during 27-29 April 2022.
- Oral presentation on “Thar Sadabahar: A new variety of Coccinia for round the year cultivation” in 2<sup>nd</sup> Indian Horticulture Summit-2022 organized at NAU, Navsari (Guj.) during 27-29 April 2022.
- Oral presentation on “Drumstick: An alternative for nutritional security and climate resilience through agri-entrepreneurship in National Symposium on 'Self-Reliant Coastal Agriculture' organised by Association for coastal agricultural research (ACAR) at ICAR-Central Coastal Agricultural Research Institute, Goa during 11-13 May 2022

**Dr. J.S. Gora**

- Oral presentation on “Performance evaluation of citrus scion and rootstock cultivars under hot arid environment of Rajasthan” in National conference cum 9<sup>th</sup> Rajasthan science congress on “harnessing frontier science and technologies for food, nutrition, health and environmental security” during 15-17 December 2022 at SKNAU, Jobner, Jaipur.

**Dr. Gangadhara K.**

- Oral presentation on “Purple Indian bean: A nutraceutical rich bean for health security” in 2<sup>nd</sup> Indian Horticulture Summit-2022 organized at NAU, Navsari (Gujarat) during 27-29 April 2022.
- Oral presentation on “Genetic divergence studies in Indian bean (*Lablab Purpureus* var. *typicus*) under rainfed semi-arid conditions” in 2<sup>nd</sup> Indian Horticulture Summit-2022 organized at NAU, Navsari (Gujarat) during 27-29 April 2022.
- Oral presentation on “Genetic variability in pole type dolichos bean under rainfed semi-arid conditions” in National Symposium on 'Self-Reliant Coastal Agriculture' organised by Association for coastal agricultural research (ACAR) at ICAR-Central Coastal Agricultural Research Institute, Goa during 11-13 May 2022

**Dr. K.L. Kumawat**

- Delivered invited lecture on “Integration of plant growth regulators in precision horticulture” in the Webinar on “Recent Trends in Modern and Precision Horticulture Farming” organized by ICAR-Agricultural Technology Application Research Institute, Zone-II, Jodhpur (Rajasthan) on 30<sup>th</sup> March, 2022.
- Delivered virtual lecture on “Establishment of orchard” as a guest speaker during in Webinar on “Establishment and management of Orchard” organized by Horticulture Training Institute Uchani, Karnal (Haryana), Department of Horticulture, Haryana on 12<sup>th</sup> May, 2022.

**Dr. Kamlesh Kumar**

- Oral presentation on “Exploitation of genetic diversity of ker {*Capparis deciduas* Edgew (Forssk.)} through standardization of multiplication technique and plant standards' in 'National Seminar on Fruit production in Eastern Tropical Region of India: Challenges and Opportunities' held at ICAR-Indian Institute of Horticultural Research, Bengaluru' RRS, Bhubaneswar during 24-26 March, 2022”.

**Dr. Hanuman Ram**

- Delivered invited lecture on the topic “Advances & research in Vegetables in special reference to cucurbits” at College of Agriculture, Ummedganj, Kota and lecture was delivered on 14.03.2022.
- Presented oral presentation on “Standardization of horticultural maturity indices through growth and development study in bottle gourd” in “2<sup>nd</sup> Indian Horticulture Summit-2022” organized at NAU, Navsari, Gujarat during 27-29 April 2022.
- Presented oral presentation on “Evaluation of Round Melon [*Praecitrullus fistulosus* (Stocks) Pangalo] germplasm under hot arid climate of Rajasthan” in “VI<sup>th</sup> International Conference in Hybrid Mode on Global Research Initiatives for Sustainable Agriculture and Allied Sciences-GRISAAS 2021” during 13-15 December 2021.
- Presented oral presentation on “Evaluation of Chilli (*Capsicum Annum* L.) Germplasm under Heat Stressed Ecosystem of Rajasthan” in “IV<sup>th</sup> International Conference in Hybrid Mode on Innovative and Current Advances in

Agriculture & Allied Sciences-ICAAAS-2022” (An International Event) during 12-14 June 2022.

**TV and RADIO TALK****Dr. D. S. Mishra**

- Delivered a TV talk in Hello Kisan on “Natural Farming” at DD Kisan on March 11, 2022.
- Delivered a radio talk on “cultivation of guava” at All India Radio Godhra on November 05, 2022.

**Dr. D. K. Sarolia**

- Delivered a TV talk on “Ber cultivation” in Hindi at Hello Kisan programme Doordarshan on 9 December, 2022 (6-7PM).

**Dr. R. K. Meena**

- Delivered a talk on “*Nursery men faldar paudho ka snavardhan*” in a special programme *kheti ri baatan* at All India Radio Akashwani, Bikaner on 25<sup>th</sup> January, 2022.

**Dr. Anita Meena**

- Delivered a radio talk on “*Importance of Natural Farming*” in Hindi at All India Radio, Bikaner 19<sup>th</sup> March, 2022.

**Dr. P. S Gurjar**

- Delivered a radio talk on Post harvest management of date palm on 29 June, 2022.

**Dr. Hanuman Ram**

- Delivered a TV talk on the topic “सब्जी फसलों का नर्सरी प्रबंधन” for the live programme "HELLO KISAN" for the channel Doordarshan Kisan on 12.07.2022 (6:00 PM 7:00 PM) through online mode.

**Dr. Pawan Kumar**

- Delivered a radio talk on “*Pramanit beej Utpadan*” at akashwani station Bikaner on 7 March, 2022

**Mr. M. K. Choudhary**

- Delivered radio talk on “Problems in date palm cultivation and their solutions” at Akashvani station Bikaner on 29 June, 2022.

**Dr. A. K. Rai**

- Delivered radio talk on “Millets production Technology” at All India Radio, Godhra on 01.09.2022.

**Dr. Raj Kumar**

- Delivered radio talk on “Scientific cultivation of marigold” at All India Radio, Godhra on 09.10.2022.



Farmers training programmes organized at CHES, Godhra

**LECTURES DELIVERED**

S. No.	Name of lecture deliver	No. of lectures delivered	Audience/Stakeholders
1.	Dr. D.K. Samadia	12	Scientists, Intellectuals, Students and farmers
2.	Dr. A.K. Singh	28	Scientists, Farmers, Students
3.	Dr. V. V. Apparao	26	Scientists, Farmers, Students
4.	Dr. D. S. Mishra	18	Scientists, Farmers, Students
5.	Dr. S.K. Maheshwari	05	Scientists, Farmers, Students
6.	Dr. S. R. Meena	50	Scientists, Farmers, Students and Visitors
7.	Dr. D.K. Sarolia	07	Scientists, Farmers, Students
8.	Dr. B.R. Choudhary	09	Scientists, Farmers, Students
9.	Dr. R.C. Balai	80	Scientists, Farmers, Students, State dept. officials
10.	Dr. R.K. Meena	06	Scientists, Farmers, Students
11.	Dr. M.K. Berwal	04	Scientists, Farmers, Students
12.	Dr. Ramesh Kumar	02	Scientists, Farmers, Students
13.	Dr. R.P. Meena	02	Scientists, Farmers, Students
14.	Dr. Anita Meena	16	Farmers, Students
15.	Dr. L. P. Yadav	34	Scientists, Farmers, Students
16.	Dr. Gangadhara K.	33	Scientists, Farmers, Students
17.	Dr. J.S. Gora	05	Scientists, Farmers, Students
18.	Dr. Pawan Gurjar	05	Scientists, Farmers, Students
19.	Dr. K.L. Kumawat	01	Scientists, Farmers
20.	Dr. Hanuman Ram	07	Scientists, Farmers, Students
21.	Dr. M.K. Choudhary	06	Farmers, Students
	<b>Total</b>	<b>356</b>	

## 5 (b) SCSP AND TSP ACTIVITIES

The institute has organized more than 35 training programmes for empowerment of scheduled caste and scheduled tribe farmers on “Improved arid horticultural crop production and value addition technologies”. More than 600 farmers were benefitted through the training programmes. The inputs like fertilizers, seeds of improved varieties of vegetable, spices, vegetable seed packet for kitchen garden, milk collection canes, sprayers, technical folders were distributed to farmers

### SC farmers training programme under SCSP

- Under SCSP Programme, a training and input distribution programme was organized and Home appliance, Kitchen Gardening Vegetable seed kit, Technical folder were distributed among the SC Farmers (29 Farmers) of Jaimalsar village, of Bikaner distt. on the occasion of International Women day on 08.03.2022.
- One day SC farmers training programme was organized and agril input like sprayer machine Kitchen Gardening Vegetable seed kit, Technical folder was distributed among Sc farmers of Lalamdesar village of Bikaner distt.on 09.03.2022
- A one day training programme of Sc farmers of Lunkaransar block was conducted and input distribution Green shednet, Kitchen Gardening Vegetable seed kit, Technical folder were distributed among the SC Farmers on 21.03.2022.
- Under SCSP a one-day SC farmers (Jhajhu and Kolayat village) training was organized and agril inputs i.e. Green shadenet, Vegetable seed kit for kharif and rabi, and technical folders were distributed on 21.05.2022.
- SC farmers (Dhaneru of Shri Dungargarh block) training was organized and agril inputs i.e. Grain seed bin, Vegetable seed kit for kharif and rabi and technical folders were distributed on 21.05.2022.
- One day SC farmers training programme was organized and agril input like Ground nut Seed ,Kitchen Gardening Vegetable seed kit, Technical folder was distributed among Sc farmers of Bapeu (Sri Dungargarh) of Bikaner distt.on 24.05.2022.
- SC farmers (Derajsar, Sudsar village) training was organized and agril inputs i.e. Ground nut Seed, Vegetable seed kit for kharif and rabi and technical folders were distributed on 25.05.2022.
- One day training programme of SC farmers of Benisar village of Sri Dungargarh block was organized and input distribution Ground nut Seed, Kitchen Gardening Vegetable seed kit, technical folder were distributed among the SC Farmers on 26.05.2022.
- SC farmers (Ladera Malasar & Husangsar) training was organized and agril inputs i.e. Ground nut Seed, Vegetable seed kit for kharif and rabi and technical folders were distributed on 21.06.2022.
- Under SCSP, SC farmers training and input distribution programme was organized and clusterbean, Kitchen Gardening Vegetable seed kit, technical folder were distributed among the SC Farmers (25 Farmers) of Jhajhu, Kolayat of Bikaner distt. on 22.06.2022.
- Conducted one day SC farmers training and input distribution programme of Bigga, Dungarpur block on “Improved production technologies of arid fruit crops” on 23.06.2022.
- One day training programme of SC farmers of Kanwalisar, Nokha Distt. Bikaner was organized and input distribution Clusterbean seed, Kitchen Gardening Vegetable seed kit, technical folder were distributed among the SC Farmers on 02.07.2022.
- SC farmers (Raner, Shersar Chhatargarh Block) training was organized and agril inputs i.e. Clusterbean seed, Spade with handle, Vegetable seed kit for kharif and rabi and technical folders were distributed on 08.07.2022.
- One day training programme of SC farmers of Shekhsar, Lunkaransar block of Bikaner distt. was organized and input distribution Clusterbean seed, spade with handle, pamphlets, Kitchen Gardening Vegetable seed kit, Technical folder were distributed among the SC Farmers on 12.07.2022
- Conducted one day SC farmers training and input distribution programme of Kotri in Kolayat block and input i.e. clusterbean, vegetable seed kit for kharif and rabi, spade, technical folders etc. on 28.07.2022.
- Organized One day training programme of SC farmers of Gogelav of Nagaur distt. and input distribution Cumin seed, Sonf, Vegetable seed kit for Rabi, Pamphlets were distributed among

- the SC Farmers on 29.08.2022.
- Conducted SC farmers of Barmer distt and training programme on nursery management were given and and planting materials were distributed i.e. Khejri and mulberry plants on dated 31.08.2022.
  - At Khinchiya village, SC farmers (49) training programme on arid horticulture fruit and vegetable crops was organized and inputs like Vegetable seed kit for Rabi and Kharif., Micronutrients and Pamphlets were distributed on 09.09.2022.
  - Three days SC women farmers (25) training for women empowerment were given to the kishmideshar and Gangasahar of Bikaner Disrr and sewing machines, vegetables seed kit for rabi and kharif and folders were distributed on 15 17 September, 2022.
  - A Three days SC farmers training on Khejri propagation and nursery management were conducted and inputs like DAP, micro nutrient bags, plants like lasora, mulberry, falsa, sahanjan etc. were distributed during 20 22 Sept., 2022.
  - Conducted one day SC farmers of 8 KYD (Khajuwala) Bikaner training programme on Rabi season vegetable crops and agril. inputs like vegetable seed packets for rabi and sonf and technical folders were distributed to the farmers on dated 23.09.2022.
  - Conducted one day SC farmers training and input distribution programme of Nachna village in pokaran block and input i.e. Cumin seed, vegetable seed kit for kharif and rabi, technical folders etc. on 24.09.2022.
  - Conducted one day SC farmers training and input distribution programme of Chak 396, Lunkaransar on “Water nutrient management in vegetable production” on 11.10.2022.
  - Conducted one day SC farmers training and input distribution programme of 13 FF Manaksar and Sri Ganganagar on “Improved production technologies for the production of vegetables during rabi season” on 12.10.2022.
  - Conducted one day SC farmers training cum input distribution programme of Meghasar and input like DAP, Micronutrient vegetable seed kits for rabi and kharif on 14.10.2022
  - On the occasion of PM samman nidhi programme, SC farmers training was organized and inputs (MAO, DAP, Spade and vegetable seed kits for rabi and kharif was distributed to SC farmers of Ambasar, Sujasar village on 17.10.2022.
  - SC Women farmers training cum input distribution programme was organized and lecture on women empowerment for rural people was delivered and sewing machines, and vegetable seed kits for rabi & kharif and technical folders were distributed to SC women farmers of Beechwal on 18.10.2022.
  - Training of SC farmers of Persneu (Churu) under SCSP was conducted on arid fruit and vegetable production technology and inputs like vegetable seed kits for rabi & kharif and technical folders were distributed on 19.10.2022.
  - SC farmers training cum agriculture input distribution programme was conducted at Raghunathgarh and Kushalpura village of Sikar distt. and input like vegetable seed kits for rabi & kharif and technical folders were distributed on 20.10.2022.
  - Conducted one day SC farmers training and input distribution programme of Meghasar village on “Low tunnel technology for cucurbitaceous vegetable production during off season” on 09.12.2022.
  - Conducted one day SC farmers training and input distribution programme of Naaryon ki basti and Mad (Kolayat) on “Low tunnel technology for cucurbitaceous vegetable production during off season” on 12.12.2022.
  - Conducted one day SC farmers training and input distribution programme of Jemla (Pokaran) on “Management practices to save the fruit and vegetable crops during adverse climatic conditions” on 13.12.2022.
  - Conducted one day SC farmers training and input distribution programme of Hameera (Jaisalmer) on “Management practices to save the fruit and vegetable crops during adverse climatic conditions” on 14.12.2022.
  - Conducted one day SC farmers training and input distribution programme of Ramgarh on “Management practices to save the fruit and vegetable crops during adverse climatic conditions” on 15.12.2022.
  - One day SC farmers school programme cum input distribution programme was conducted at Kolasar village of Bikaner distt and inputs like vegetable seed kits for rabi & kharif and technical folders were distributed to the SC farmers on 20.12.2022.



Training programme and input distribution under SCSP scheme

### **ST (Tribal) farmers programme under TSP**

- Under TSP, ST farmers training programme on Training for farmers in horticulture crop production was organized in tribal areas of Udaipur (Jawar Mines, Tidi, Kaya, Teh. Girwa in Udaipur and inputs like vegetable seed kit for rabi and kharif and technical folders were distributed on 16.11.2022.
- One day ST farmers training programme on Promotion and distribution of agricultural inputs i.e. kitchen gardening seed kits for rabi

and kharif. was organized in tribal areas of Udaipur (Barapal, Jabla and Baran in Udaipur and inputs like vegetable seed kit for rabi and kharif and technical folders were distributed on 17.11.2022.

- Under TSP, one day ST farmers (Men and Women farmers) training on Promotion kitchen gardening seed kits for rabi and kharif and nursery management was organized at KVK Flouj and Antri (Dungarpur) and inputs like vegetable seed kit for rabi and kharif and

technical folders were distributed on 18.11.2022

- One day ST farmers training programme on promotion and distribution of agricultural inputs i.e., kitchen gardening seed kits for rabi

and kharif. was organized in tribal areas of kherdabra and nearby areas in Banswara distt and inputs like vegetable seed kit for rabi and kharif and technical folders were distributed on 19.11.2022.



Training programme and input distribution under TSP scheme



## 6. TRAINING AND CAPACITY BUILDING

### Training and Capacity Building of ICAR employees

The following staff member of the institute underwent in different training programmes

Scientists			
Name	Topics	Organization	Duration
Dr. A.K. Singh	Agri-based Technological Interventions for Entrepreneurship Development in Semi-Arid Zone	ICAR-DRMR, Bharatpur, Rajasthan	22-26 August, 2022
Dr. D. S. Mishra	Monitoring & Evaluation of Government Schemes	Institute of Secretariat Training and Management (DOPT), GOI, New Delhi	07 February, 2022
	Intellectual Property Rights Webinar Series - IP Awareness/Training	Intellectual Property Office, India	05 August, 2022
	Cyber Security Awareness	Section Officer Horticulture Science Division	03 October, 2022
	Extension strategies for promotion of climate resilient horticultural technologies in hot arid and semi-arid regions	ICAR-CIAH, Bikaner and MANAGE, Hyderabad	11-15 October, 2022
Dr. S. R. Meena	Pathways for successful implementation of SC sub-plan schemes in ICAR	ICAR-NAARM, Hyderabad	18-19 August 2022
Dr. B.R. Choudhary	Managerial supervisory skill	HRM unit ICAR, New Delhi	18-21 April 2022
	MDP on Design Thinking in Agricultural Research and Education	ICAR-NAARM, Hyderabad	23-28 May, 2022
	Intellectual Property Awareness/ Training Programme	Intellectual Property Office, India	05 August, 2022 online
	Training Workshop for Vigilance Officers of ICAR Institutes	ICAR-NAARM, Hyderabad	24-26 August, 2022
Dr. M. K. Jatav	Pathways for successful implementation of SC sub-plan schemes in ICAR	ICAR-NAARM, Hyderabad	18-19 August 2022

Dr. R.C. Balai	Competency enhancement Programme for effective implementation of training functions by HRD nodal officers of ICAR	ICAR-NAARM, Hyderabad	21-23 February 2022
	Pathways for successful implementation of SC sub-plan schemes in ICAR	ICAR-NAARM, Hyderabad	18-19 August 2022
Dr. R.K.Meena	Post-entry quarantine for imported planting material of horticultural crops	ICAR-NPBGR, New Delhi	17 September 2022
	Extension strategies for promotion of climate resilient horticultural technologies in hot arid and semi-arid regions	ICAR-CIAH, Bikaner and MANAGE, Hyderabad	11 - 15 October, 2022
Dr. Ramesh Kumar	Field diagnosis and management of plant parasitic nematode	National Institute of Plant Health Management, Hyderabad	14 - 18 March, 2022
Dr. R.P. Meena	Biosecurity and Biosafety: Policies, Diagnostics, Phytosanitary Treatments and Issues	ICAR-NBPRG, New Delhi	02-11 August, 2022
	Post-entry Quarantine for Imported Planting Material of Horticultural Crops	ICAR-NBPGR, New Delhi	17 September, 2022
Dr. Anita Meena	Pathways for successful implementation of SC sub-plan schemes in ICAR	ICAR-NAARM, Hyderabad	18-19 August, 2022
Dr. Chet Ram	Biosecurity and biosafety: policies, diagnostics, phytosanitary treatments and issues	ICAR-NBPGR, New Delhi	02-11 August, 2022
	Post-entry quarantine for imported planting material of horticultural crops	ICAR-NBPGR, New Delhi	17 September, 2022
Dr. P. S. Gurjar	Pathways for successful implementation of SC sub-plan schemes in ICAR	ICAR-NAARM, Hyderabad	18-19 August, 2022
Dr. L. P. Yadav	Natural resource management for horticulture	ICAR-CRIDA, Hyderabad	9-11 February, 2022

Dr. Gangadhara K.	Recent Advances in Chilli Crop Improvement	ICAR-IIHR, Bengaluru	7-9 September, 2022
Dr. Hanuman Ram	Biosecurity and Biosafety: Policies, Diagnostics, Phytosanitary Treatments and Issues	ICAR-NBPGR, New Delhi	2-11, August, 2022
	Recent Advances in Chilli Crop Improvement	ICAR-IIHR, Bengaluru	7- 9 September, 2022
Dr. Pawan Kumar	Bio-fortification of Staple Food Crops Through Conventional and Molecular Approaches	Department of Molecular Biology, Biotechnology & Bioinformatics CCS Haryana Agricultural University, Hisar	03-23 January, 2022
Mr. M. K. Choudhary	Pathways for successful implementation of SC sub-plan schemes in ICAR	ICAR-NAARM, Hyderabad	18-19 August, 2022
<b>Technical</b>			
Sh. Rakesh Meel (STA)	Motivation, Thinking and communication skills for technical officers	ICAR-IISWC-Dehradun through NAARM	18-24 May, 2022
	Tech staff associated with farm management/ Farm Manager of ICAR	ICAR-IIFSR Modipuram	22-28 February, 2023
Sh. A. V. Dhobi (ACTO)	National Pension Scheme (NPS) for Administrative and Finance staff of ICAR	ICAR-NRRI Cuttuck	16-18 June, 2022
Sh. Bhoj Raj Khatri (CTO)	E-Governance Application in ICAR (ERP system, E Office, EHRM, TMIS Sparrow	HRM Unit ICAR-IASRI New Delhi-110012	22-28 February, 2023
Sh. Sanjay Patil (ACTO)	E-Governance Application in ICAR (ERP system, E Office, EHRM, TMIS Sparrow	HRM Unit ICAR-IASRI New Delhi-110012	22-28 February, 2023

### Seminar/ symposium attended

Dr. D.K. Samadia

- Attended 26<sup>th</sup> Research Worker Group Meeting of AICRP on Arid Zone Fruits at ANDUAT, Ayodhya (UP) from 28-30 April 2022, and act as panelist of Session-II : Plant Genetic Resource Management.
- Attended 40<sup>th</sup> annual group meeting of AICRP on vegetable crops of IIVR, Varanasi from 15 -

18 June 2022 virtually.

Dr. V. V. Apparao

- Attended the 2<sup>nd</sup> Horticultural Summit-2022 from April 27-29 in 2022 at Navasari agricultural University, Navasari, Gujarat, India
- Dr. S.K. Maheshwari
- Attended National Symposium (online) on “Recent Trends in Phytopathology to Address Emerging Challenges for Achieving Food

Security organized by ICAR-VPKAS, Almora and Indian Phytopathological Society (Mid-Eastern Zone Chapter) during 21-22 February, 2022.

- Attended 2<sup>nd</sup> Indian Horticultural Summit 2022 on “Horticulture for Prosperity and Health Security” at Navsari Agricultural University, Navsari, Gujarat during 27-29 April, 2022.

Dr. A.K. Singh

- Attended 2<sup>nd</sup> Indian Horticulture Summit-2022 organized at NAU, Navsari (Gujarat.) during 27-29 April, 2022.

Dr. D. S. Mishra

- Participated in the National Webinar on Utilization of Fruit Waste for Economic and Nutritional Security' on February 11, 2022 organized by ICAR-NAHEP-IG at UBKV, Cooch Behar, West Bengal through virtual mode.
- Attended “Intellectual Property Rights Webinar Series- IP Awareness/Training” held on 01-05<sup>th</sup> August, 2022 on Virtual Platform, organized by Intellectual Property Office, India through virtual mode.

Dr. D.K. Sarolia

- Attended and presentation in KRIBHCO cooperative conference organized by Krishi Bhawan, Bikaner on 28 March, 2022
- Participated in “National workshop on sustainable agriculture in dry regions” organized by ICAR-CAZRI, Jodhpur on 29 August, 2022.
- Attended national conference on “Innovative resource management approaches for coastal and inland ecosystems to sustain productivity and climate resilience” organized by NAU, Navsari, Gujarat during 13-15 October, 2022.
- Attended “National webinar on significance of experimental designs in agricultural research” organized by SKN AU, Jobner, Jaipur on 29 June, 2022
- Attended online two lectures on “Excellence in peer review: How to be an effective peer reviewer” (19 March, 2022) and “Publishing your research open access” (16 March, 2022) conducted by Taylor and Francis group.

Dr. B.R. Choudhary

- Attended one day international webinar on 'Prospects of varieties/ crops developed through genome editing (regulatory framework, technologies and experience)' organized by PPV&FRA, New Delhi on

24.05.2022.

Mr. R.C. Balai

- Participated in one day Webinar organized during the Mega campaign on "Annadata Devo Bhava" under the progrsmme Azadi Ka Amrit Mahotsava, Government of India in virtual (online) at ICAR-CIAH, Bikaner on 23.04.2022.
- Attended/Participated a Three days online training programme on “Competency enhancement programme for effective implementation of training functions by HRD Nodal Officers of ICAR from 21 to 23 Feb., 2022 on virtual mode
- Attended one day national webinar on Soil Health Management in Horticulture Ecosystem on virtual mode organized by CISH Lucknow on 10.08.2022.
- Participated and interacted in online National Workshop on " Pathways for the Successful implementation of SC Sub-Plan Scheme in ICAR" organized by NAARM, Hyderabad from 18.08.2022 to 19.08.2022.
- Attended IGFRI Diamond Jubilee Online Lecture Sries-2022 on "Entrepreneurship development in processing fodder and allied crops" orgonized by Agri-Business Incubation Centre of ICAR-IGFRI, Jhansi in collaboration with Indian Society of Agriculture Engineering, New Delhi and Range Management Society of India, Jhansi

Dr. R.K. Meena

- Attended “31<sup>st</sup> National conference on innovative resource management approaches for coastal and inland ecosystem to sustain productivity and climate resilience” held at SCSA in collaboration with NAU, Navsari, Gujarat during 13-15 October 2022.
- Attended VIIth international conference on “Global Research Initiative for sustainable Agriculture and Allied Science held Birsa Agriculture University, Ranchi, Jharkhand, India during 21-23 November 2022.

Dr. M.K. Berwal

- Attended National conference: Emerging Innovations in Plant Molecules for Achieving Food and Nutritional Security: ay NAU, Navsari during September 22-23, 2022.
- Attended a seminar on Mental Health at ICAR-CIAH Bikaner Delivered by Dr. D.P. Poonia.

Dr. R.P. Meena

- Attended IPS 8<sup>th</sup> International Conference

(hybrid mode) on “Plant Pathology: Retrospect and Prospects”. at Sri Karan Narendra Agriculture University, Jobner, Jaipur, Rajasthan, India during March 23-26, 2022.

Dr. Anita Meena

- Attended “International Conference on ICAAAS-2022 at HPU, Shimla on date 12-14 June 2022.
- Attended in the one-day Symposium (hybrid mode) on 'Soils: Where food begins' on 30 November 2022 as a part of World Soil Day 2022 celebrations organized jointly by the Division of Soil Science and Agricultural Chemistry, ICAR-IARI, New Delhi and Indian Society of Soil Science (ISSS)-Delhi Chapter.

Dr. L. P. Yadav

- Attended 2<sup>nd</sup> Indian Horticulture Summit-2022: Horticulture for prosperity and health security held at NAU, Navsari (Guj.) during 27-29 April 2022.
- Attended National Symposium on 'Self-Reliant Coastal Agriculture' organised by Association for coastal agricultural research (ACAR) held at ICAR-Central Coastal Agricultural Research Institute, Goa during 11-13 May 2022
- Attended “AGRF Summit virtually on 3 March, 2022.

Dr. Gangadhara K.

- Attended 2<sup>nd</sup> Indian Horticulture Summit-2022: Horticulture for prosperity and health security held at NAU, Navsari (Guj.) during 27-29 April 2022.
- Attended National Symposium on 'Self-Reliant Coastal Agriculture' organised by Association for coastal agricultural research (ACAR) held at ICAR-Central Coastal Agricultural Research Institute, Goa during 11-13 May 2022

Dr. J.S. Gora

- Participated in National conference cum 9<sup>th</sup> Rajasthan science congress on “Harnessing Frontier Science and Technologies for Food, Nutrition, Health and Environmental Security” during 15-17 December 2022 at SKNAU, Jobner, Jaipur.
- Participated in Megha Show ICAR & State Level Kisan Mela dated on 31.05.2022 organized by ICAR-CSWRI, Avikanagar at ICAR- NIAM, Jaipur Rajasthan.

Dr. P. S. Gurjar

- Participated and delivered Oral Paper presentation on “Technology developed for *sangri* processing and packaging to promote horticultural entrepreneurship in rural areas”.

In National conference cum 9<sup>th</sup> Rajasthan Science Congress on Harnessing Frontier Sciences and Technologies for Food, Nutrition, Health and Environmental Security, December 15-17, 2022, SKNAU, Jobner, Jaipur.

Dr. Kamlesh Kumar

- Participated in 26<sup>th</sup> All India Coordinated Research Project on Arid Fruits (AICRP-AZF) meeting held at ANDUAT, Kumarganj, Ayodhya (UP) during 28-30 April 2022.
- Attended online 'National Seminar on Fruit production in Eastern Tropical Region of India: Challenges and Opportunities' held at ICAR-Indian Institute of Horticultural Research, Bengaluru' RRS, Bhubaneswar during 24-26 March 2022.

Dr. Hanuman Ram

- Attended “2<sup>nd</sup> Indian Horticulture Summit-2022” held at NAU, Navsari, Gujarat during 27-29 April 2022.
- Attended ICAAAS-2022 “IV<sup>th</sup> International Conference in Hybrid Mode on Innovative and Current Advances in Agriculture & Allied Sciences-ICAAAS-2022” (An International Event)” during 12-14 June 2022” through virtual mode.
- Attended National Conference cum 9<sup>th</sup> Rajasthan Science Congress held at SKNAU, Jobner during 15-17 December, 2022.
- Attended 40<sup>th</sup> annual group meeting of AICRP on vegetable crops of IIVR, Varanasi from 15-18 June 2022 virtually.

Dr. Pawan Kumar

- Attended monthly seminar as a part of “Azadi Ka Amrit Mahotsav” delivered by Dr. K. L. Kumawat on “Integration of plant growth regulators to enhance orchard efficiency February 26, 2022.
- Attended monthly seminar as a part of “Azadi Ka Amrit Mahotsav” delivered by Dr. Hanuman Ram on “Use of RNAi technology for solanaceous crops” during February 26, 2022.
- Attended winter school on “Biofortification of Staple Food Crops Through Conventional and Molecular Approaches” organized by Department of Molecular Biology, Biotechnology & Bioinformatics, CCS Haryana Agricultural University, Hisar during January 03-23, 2022.
- International Webinar on Citrus Postharvest Handling, Processing Technology, and Value Chain Management organized by Department of Agriculture and Environmental Sciences,

National Institute of Food Technology Entrepreneurship and Management (NIFTEM), Kundli, India on April 11, 2022.

- National Webinar on “Significance of Experimental Designs in Agricultural Research” on June 29th, 2022 organized by the Department of Statistics, Mathematics & Computer Science and World Bank-ICAR Funded National Agricultural Higher Education Project (NAHEP), Sri Karan Narendra Agriculture University, Jobner, Jaipur, Rajasthan
- Attended National Conference organised by Andaman Science Association in collaboration with ICAR-Central Island Agricultural Research Institute, Port Blair and Department of Biotechnology, New Delhi on Underutilized Horticultural Genetic Resources: Conservation and Utilization (NCUHGR-2022) during June 3-4, 2022.

Dr. M.K. Choudhary

- Attended monthly seminar as a part of “Azadi Ka Amrit Mahotsav” delivered by Dr. K. L. Kumawat on “Integration of plant growth regulators to enhance orchard efficiency February 26, 2022.
- International Webinar on Citrus Postharvest Handling, Processing Technology, and Value Chain Management organized by Department of Agriculture and Environmental Sciences, National Institute of Food Technology Entrepreneurship and Management (NIFTEM), Kundli, India on April 11, 2022.
- Attended “2<sup>nd</sup> Indian Horticulture Summit-2022” held at NAU, Navsari, Gujarat during 27-29 April 2022.
- Attended ICAAAS-2022 “IV<sup>th</sup> International Conference in Hybrid Mode on Innovative and Current Advances in Agriculture & Allied Sciences-ICAAAS-2022” (An International Event) during 12-14 June 2022” through virtual mode.
- National Webinar on “Significance of Experimental Designs in Agricultural Research” on June 29th, 2022 organized by the Department of Statistics, Mathematics & Computer Science and World Bank-ICAR Funded National Agricultural Higher Education Project (NAHEP), Sri Karan Narendra Agriculture University, Jobner, Jaipur, Rajasthan
- Attended National Conference organised by Andaman Science Association in collaboration

with ICAR-Central Island Agricultural Research Institute, Port Blair and Department of Biotechnology, New Delhi on Underutilized Horticultural Genetic Resources: Conservation and Utilization (NCUHGR-2022) during June 3-4, 2022 through virtual mode.

Dr. Raj Kumar

- Attended 2<sup>nd</sup> Indian Horticulture Summit held on 27-29 April, 2022 at Navsari Agricultural University, Navsari, (Gujarat).

Dr. A. K. Rai

- Attended 2<sup>nd</sup> Indian Horticulture Summit held on 27-29 April, 2022 at Navsari Agricultural University, Navsari, (Gujarat).

### Meeting Attended

Dr. D. K. Samadia

- Acted as a Guest of Honour in the “Consultation meet on date palm cultivation” jointly organized by Indian Council of Agricultural Research, Sardarkrushinagar Dantiwada Agricultural University and Indian Date Palm Society at Date palm research station, SDAU, MundraKachchh, Gujarat on 08/07/2022.
- Acted as a convener of programme “Mega Campaign on Annadata Devo Bhava under Azadi ka Amrit Mohotsav (AKAM) organized at ICAR-CIAH, Bikaner from 23-24 April 2022, and attended “Inaugural address and presented overview on natural framing” on 23/04/2022.
- Acted as a organizer of “30<sup>th</sup> Foundation Day of ICAR-CIAH” and Guest of Honour of the function on 01/10/2022 at ICAR-CIAH, Bikaner.
- Acted as a Guest of Honour in “World Camel Day Programme” organized by ICAR-NRCC, Bikaner on 22/06/2022.
- Acted as a Guest of Honour in “ICAR Zonal Sports Tournament-2022” organized by ICAR-NRCC, Bikaner on 22/11/2022.
- Acted as a Guest of Honour in the “Camel Festival-2023” organized by ICAR-NRCC, Bikaner on 14/01/2023.
- Acted as a Guest of Honour in on-campus training programme for SCSP farmers organized by ICAR-CSWRI, Regional Station, Bikaner dated 29/08/2022.
- Acted as a Chief Guest of virtual collaborative training programme “Extension strategies for promotion of climate resilient horticultural technologies in hot arid and semi-arid regions” organized by ICAR-CIAH, Bikaner and NIAEM (MANAGE), Hyderabad from 11-15 October 2022, dated 11/10/2022.

- Attended Institute Technology Management Committee meetings as chairman at ICAR-CIAH, Bikaner.
- Attended a series of VC meetings for PEQ facilities as organized by MIDH Division, Department of Agriculture & Farmers Welfare, Krishi Bhawan, New Delhi.

Dr. A. K. Singh

- Acted as a member in the committee for clearance of probation and confirmation of scientist on 03/06/2022 at ICAR-DMAPR, Anand.
- Acted as a chairman in the departmental screening committee meeting for MACP assessment case of administrative staff of ICAR-DMAPR, Anand on 02/7/2022.
- Attended and presented AICRP reports during Annual meeting of AICRP on AZF during 28-30/04/2022 at NDAUT, Ayodhya, Uttar Pradesh.

Dr. S.K.Maheshwari

- Participated in Zonal Sports Tournament (West) of ICAR in Chess game organized by ICAR-NRC on Camel, Bikaner on 22-25 November, 2022.
- Attended 'Kisan Samman Nidhi Programme' by Hon'ble PM (online) on 01-01-2022.
- Attended ITMC meeting as Member regarding technologies developed by Institute on 09-02-2022, 31-03-2022 and 06-06-2022.
- Attended lecture on Role of Extension in Dissemination of IPM in the Country in National Campaign online organized by ICAR-NCIPM, New Delhi on 26-02-2022.
- Attended inaugural function of 'Climate Control Chamber' at the Institute on 07<sup>th</sup> March, 2022 (online) by DDG (Hort.), ICAR, New Delhi.
- Participated International Yoga Day at this Institute on 21-06-2022.
- Participated in Hindi Workshop and lecture attended on Mental Health by Dr. D. S. Poonia and his team, Mindroot Foundation at this Institute on 24-06-2022.
- Participated as Member in PMEC meeting at this Institute on 29-06-2022.
- Attended meeting with Shri G. P. Sharma (Joint Secretary-Finance) on 10-08-2022.
- Participated in Foundation Day function of ICAR-CIAH, Bikaner on 1<sup>st</sup> October, 2022.
- Attended 'Kisan Samman Nidhi Sammelan' by Hon'ble PM (online) on 17-10-2022.
- Attended lecture (online) on Preventive

Vigilance and Purchase Procedure delivered by Shri D. K. Agnihotri, ICAR-CISH, Lucknow on 04-11-2022.

- Participated in Zonal Sports Tournament (West) of ICAR in Chess game organized by ICAR-NRC on Camel, Bikaner on 22-25 November, 2022.

Dr. A.K.Singh

- Acted as a member in the committee for clearance of probation and confirmation of scientist on 03/06/2022 at ICAR-DMAPR, Anand.
- Acted as a chairman in the departmental screening committee meeting for MACP assessment case of administrative staff of ICAR-DMAPR, Anand on 02/7/2022.
- Attended and presented AICRP reports during Annual meeting of AICRP on AZF during 28-30/04/2022 at NDAUT, Ayodhya, Uttar Pradesh.

Dr. D.K. Sarolia

- Attended ZREAC rabi season meeting held at ARS, SK RAU, Bikaner (20-21 September, 2022).
- Attended institute meetings viz., ITMU meeting (30/3/2022 & 11-11-2021), Technical personnel T3/T4 grade in KVKs anomaly settlement ICAR-CIAH (29-1-2022), Budget & expenditure review meeting (29/3/2022), Institute variety release committee (IVRC) meeting 2/4/2022.
- Member of assessment committee for promotion case of technical staff (22 March 2022).
- Meeting attended of clearance of probation and confirmation at ICAR-CIAH, Bikaner 29.12.2022.

Dr. D. S. Mishra

- Attended the Scientific Advisory Committee meeting of KVK, Dahod (AAU, Anand) as member on March 25, 2022.

Dr. B. R. Choudhary

- Attended a meeting of Institute Technology Management Committee held on 06-06-2022 at ICAR-CIAH, Bikaner.
- Attended 40<sup>th</sup> Annual Group Meeting of AICRP (VC) organized virtually by ICAR-IIVR, Varanasi from June 15-17, 2022.

Dr. R.C. Balai

- Acted as a member of assessment committee member held on 28.02.2022 at ICAR -NRC Camel, Bikaner.
- Acted as a member of assessment committee member held on 22.03.2022 at ICAR-CIAH, Bikaner

- Scientists-teachers-student interaction meeting was organized at Seenthal on 20.09.2022. Interaction with students was carried out and discussed about arid horticultural crops as well as scope of agriculture-based study and other allied area.

Dr. R.K. Meena

- Participated in International camel festival organized at NRCC campus, Bikaner on 06.02.2022
- Participated in mega campaign on “Annadata Devo Bhava” under Azadi Ka Amrit Mahotsav organized at ICAR-CIAH, Bikaner during 23-24 April, 2022.
- Participated in consultation meet on date palm held at Date palm Research Station, Mundra on 8 July 2022.
- Attended AICRP on Arid Zone Fruits 26<sup>th</sup> Research Workers Meeting held at Acharya Narendra Dev Agriculture, University, Ayodhya during 28-30 April 2022.
- Participated in foundation day function of ICAR-CIAH, Bikaner on 1<sup>st</sup> October 2022.

Dr. Ramesh Kumar

- Attended ICAR-All India Coordinated Research Project on Arid Zone Fruits Annual Group Meeting 2022, held from 28 to 30 April, 2022 at ANDUAT, Ayodhya.
- Attended “Consultation Meet on Date Palm Cultivation” organized at Date palm Research Station, SDAU, Mundra on 8<sup>th</sup> July, 2022
- Attended “District Level Technical Committee (DLC) Meeting” regarding scale of finance on 21 December, 2022 at Collectorate, Bikaner chaired by district collector Bikaner.

Dr. Chet Ram

- Attended interaction meeting of date palm related research and development work at ICAR-CIAH on 8<sup>th</sup> July 2022.

Dr. Anita Meena

- Virtual participation in meeting “Presentation by DDG (AS) on November 22, 2022 at 4:30 PM
- Virtual Participated Indian Crop Improvement Programme: New Vistas Lecture #39 Azadi Ka Amrit Mahotsav
- Virtual participation presentation by DDG(CS) on activities and aspirations of ICAR on 14<sup>th</sup> November, 2022 at 10 .M Speaker- Dr. V B Mathur, Chairperson, National Biodiversity Authority, Govt. of India, Title- Biodiversity Governance: Global and National Perspectives, Date- 15 June.

Dr. Kamlesh Kumar

- Attended online meetings on 'Horticulture Planting Material and Creation of PEQ Facility' held at MIDH Division, Krishi Bhawan, DA&FW, MA&FW, New Delhi during 2022.
- Attended several online meetings on Drones for boosting agricultural productivity, General awareness about difference between natural and organic farming, Organic farming: Practical and practices, Suitability of aonla and bael in natural farming, Khejri, Organic farming, Natural farming etc. during January to December 2022.
- Attended IRC meeting held at ICAR-CIAH, Bikaner during 5-6 August 2022.

Dr. L. P. Yadav

- Attended PMKSS programme at KVK, Panchmahal on 17.10.2022.
- Attended workshop on promoting weather-based insurance in Gujarat organised by N.M. sadguru water and development foundation on 14.10.2022.
- Attended IVIC meeting held on 07.04.2022 virtually by ICAR-CIAH, Bikaner

Dr. Gangadhara K.

- Attended Institute Variety release committee meeting held on 7 April held on 7<sup>th</sup> April 2022 at ICAR-CIAH, Bikaner.
- Participated in 40<sup>th</sup> Annual group meeting of AICRP (VC) organized by ICAR-IIVR, Varanasi during June 15-17, 2022.
- Attended PMKSS programme at KVK, Panchmahal on 17.10.2022.
- Attended monthly seminars organised by ICAR-CIAH, Bikaner.

Dr. Hanuman Ram

- Performed examination duty as a member of flying squad team for JET-2022 Exam for admission in Agriculture Colleges conducted at examination centres of Bikaner city on 29.06.2022 at 11.00 AM to 1.00 P.M.
- Acted as external Examiner in practical exam of B. Sc. (Hons.) Ag. Pt. III Semester II at College of Agriculture (SKRAU), Bikaner on 14, 15 & 16<sup>th</sup> July 2022.

Dr. Pawan Kumar

- Participated in six-day GB 9<sup>th</sup> session of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) at Hotel Pullman, New Delhi during 19-24th September, 2022 with the theme “Celebrating the guardians of crop diversity” on plant genetic resources for food and agriculture.



## 7 (a). EMPOWERMENT OF WOMEN

### Training programmes on women empowerment

In arid region the empowerment of women is the way for economic independence of rural women and hopefully the future will bring more opportunities for them. The main aim of the training programme is to enhance the quality of life of women through increased knowledge and skills. The women need vocational training or skills also to uplift their status. So, the training programmes were organized with the objective of entrepreneurial empowerment of rural women farmers through propagation techniques for arid horticultural crops and through nursery management in arid region. For women awareness so many training programmes and skill based training programmes were conducted under SCSP scheme during 2022. A total of 1000 SC farm women were benefitted through the different training programmes and all necessary precautionary measures like social distance, compulsory use of face mask and hand sanitizing were followed as per guideline by authority. The training was based on theoretical knowledge and women trainees were also exposed to hands on training practical. The major emphasis was given to small scale home-level processing of arid fruits and vegetables. Hands-on training was provided for preparation of papad from shanjji, dehydrated vegetable from arid horticulture vegetables (kachari, kakadia and beans etc.) and also trained for preparation of snap melon sauce, ber pickle, aonla mouth freshener and watermelon rind candy. Under the training of Women empowerment through skill training and Propagation techniques in arid region under SCSP plan at ICAR-CIAH, Bikaner. The women farmers have actively participated in the training programme. Major

emphasis of the training was given to establish the nursery with arid fruit crops and vegetables, budding, grafting of CIAH released fruits varieties and kitchen gardening to small scale home nurseries in arid region. Hands-on training was provided for showing the seedling, seed production technologies seed treatment methods, post harvest technologies, filling of pot mixture, transfer of plant from portray to polybags etc. During training the inputs like seeds of improved varieties of vegetables, spices, kitchen gardening kit and some literatures of CIAH technologies were distributed to trainee of farm women. Under SCSP scheme some the sewing machines, milk cane, Grain storage tank, utensils like Pan (5litre), three fold rack, big size spoon, sieve were distributed among women farmers and they will be benefited by distribution of utensils for making valued added products at their home. The over look of CIAH, Farm by all women trainee participants and they were brief about CIAH production technologies and Quality standards, packing, storage and marketing of products were also covered during the training programmes. The CIAH technologies literatures were also distributed to SC women (BPL) under the SCSP scheme during different training programmes.

During soil health day celebration a training programme was organized at Salasar and inputs like kitchen gardening kit, vermicompost and some literatures of CIAH technologies were distributed to SC women farmers. In this training different lecture like importance of soil testing, collection of soil samples and factor affecting fertilizer requirement by the different arid vegetables were delivered. Farmers were also got trained in reparation of good quality FYM, compost and vermi-compost for good crop production .





### Specific training modules formulated and conducted for women

Specific training modules formulated and conducted for women Entrepreneurial empowerment of women through processing of arid horticultural crops Women empowerment through nursery management of arid horticultural crops Post harvest management and value addition of arid fruits and vegetables.

- Organized 3 days on campus training on “Women empowerment through skill training “under SCSP plan at ICAR-CIAH, Bikaner during 15<sup>th</sup> September to 17<sup>th</sup> September, 2022.
- Organized as course coordinator in one days training program entitled “Women empowerment for self reliance and distribution of kitchen utensils” during 8<sup>th</sup> March, 2022, under SCSP scheme at ICAR-Central Institute for Arid Horticulture, Bikaner.
- Celebrated the International Soil health day during 5<sup>th</sup> December, 2022 at Salasar village, Bikaner and 50 women farmers were participated.
- Mega campaign on “ Annadata Devo Bhava” under Azadi Ka Amrit Mahotsav (AKAM) during 22<sup>nd</sup> April, 2022.
- International Year of Millet-2023 on 17/9/2022.
- Farmer training programme on efficient and balanced use of fertilizer and input distribution under SCSP scheme. During 21<sup>st</sup> June, 2022.
- Campaigns for suitable integrated cropping system model for enhanced income of women farmers

## 7 (b). ACCESSIBILITY TO THE PERSON WITH DISABILITIES (DIVYANG):

Accessibility to the person with disabilities (divyangian) The Institute has constructed ramp and washrooms in all office buildings/guest houses

for person with disabilities (divyangian). The scientists also interacted with them and conducted their visit to museum, experimental fields etc.

## 8. AWARDS AND RECOGNITIONS

### Institute Awards

- Institute was honoured with second **“best exhibition award”** national kisan mela-2022 organized by ICAR-CSWRI, Avikanagar (Tonk) at its campus on 04.01.2022 Hon'ble Minister of states for Agriculture and Farmers' welfare GoI, Sh. Kailash Chaudhary was the chief guest of this kisan mela.
- Institute was honoured with **“second best exhibition award”** during international camel festival organized at NRCC campus, Bikaner on 06.02.2022.
- Institute was honoured with **“best exhibition award”** during farmers' fair organized by NRCSS, Tabiji, Ajmer on 11.03.2022. Hon'ble



Institute received exhibition award in various farmers' fairs

Minister of states for Agriculture and Farmers' welfare, GoI, New Delhi, Sh. Kailash Chaudhary, was the chief guest of the above fair.

- Institute was honoured with **“best exhibition award”** during celebration of "49<sup>th</sup> foundation day" of ICAR-CSWRI arid region campus, Bikaner on 07.04.2022.
- Institute was honoured with **“best exhibition award”** during Jaipur Agriculture Expo-2022 at Jaipur from 21.09.2022 to 24.09.2022,
- Received **“best exhibition award”** during ARS-CSWRI Bikaner on foundation day on 26.04.2022.



Exhibiting institute's technologies during farmers' fairs



### Individual Awards

Dr. S. K. Maheshwari

- Received 'Fellow Award' in 2<sup>nd</sup> Indian Horticulture Summit- 2022 at Navsari Agricultural University, Navsari (Gujarat) during 27-29<sup>th</sup> April, 2022.
- Received 'Second Best Oral' in oral presentation in 2<sup>nd</sup> Indian Horticulture Summit- 2022 at

Navsari Agricultural University, Navsari (Gujarat) during 27-29<sup>th</sup> April, 2022.

Dr. A. K. Singh

- Received best oral presentation award in 2<sup>nd</sup> Indian Horticulture Summit-2022 on Horticulture for Prosperity and Health Security, 27-29 April, 2022 at the Navsari Agricultural University, Navsari, Gujarat.

Dr. D. S. Mishra

- Received Certificate of Appreciation for the lecture delivered on “Vermi-composting from Fruit Waste: A way for Socio-economic Upliftment”. *In*: National Webinar on Utilization of Fruit Waste for Economic and Nutritional Security' organized on February 11, 2022 by ICAR-NAHEP-IG at UBKV, Cooch Behar, WB.
- Received Fellow of ISHRD Award-2019 & 2020 conferred by Indian Society of Horticultural Research & Development (ISHRD), Uttarakhand during Progressive Horticulture Conclave (PHC 2023) held at GBPUAT, Pantnagar, during 3-5 February 2023.

Dr. D. K. Sarolia

- Received “Leadership Award-21” from soil conservation society of India (SCSI) during national conference on “Innovative resource management approaches for coastal and inland ecosystems to sustain productivity and climate resilience at NAU, Navsari, Gujarat on 13-15 October, 2022.
- Received poster award on paper entitled “Response of ber varieties at different training systems under hot arid ecosystem (PS-II/50) in 31<sup>st</sup> national conference on “Innovative resource management approaches for coastal and inland ecosystems to sustain productivity and climate resilience at NAU, Navsari, Gujarat on 15 October, 2022.

Dr. R. K. Meena

- Received best oral presentation award in 31<sup>st</sup> National conference on innovative resource management approaches for coastal and inland ecosystem to sustain productivity and climate resilience” held at SCSI in collaboration with NAU, Navasari, Gujarat during 13-15 October 2022.

Dr. M.K. Berwal

- Received Best oral presentation award for “The New Insights of Abiotic Stresses in Horticulture: Hot Arid Region of Western Rajasthan as Potential Avenue for Molecular Farming” during National conference: Emerging Innovations in Plant Molecules for Achieving Food and Nutritional Security held at NAU, Navsari during September 22-23, 2022.
- Received “Outstanding Scientist Award” during the International Scientist Awards on Engineering, Science and Medicine, held on 09

& 10-Sep-2022, Organized by VDGGOOD® Professional Association (Reg no: U22190TN2019NPL127500)

Dr. R.P. Meena

- Received best oral presentation award in the IPS 8<sup>th</sup> International Conference (hybrid mode) at Sri Karan Narendra Agriculture University, Jobner, Jaipur, Rajasthan, India during March 23-26, 2022.

Dr. L. P. Yadav

- Received Fellow of the SHRD Society in 2<sup>nd</sup> Indian Horticulture Summit 2022 at NAU, Navsari, during 27-29 April 2022.
- Received best oral presentation award in 2<sup>nd</sup> Indian Horticulture Summit 2022 at NAU, Navsari (Gujarat), during 27-29 April 2022.
- Received best oral presentation award in National Symposium on 'Self-Reliant Coastal Agriculture' 2022 at ICAR-CCARI, Goa, during 11-13 May, 2022.

Dr. Gangadhara K.

- Received best oral presentation award in 2<sup>nd</sup> Indian Horticulture Summit 2022 at NAU, Navsari (Gujarat), during 27-29 April 2022.
- Received best oral presentation award in National Symposium on 'Self-Reliant Coastal Agriculture' 2022 at ICAR-CCARI, Goa, during 11-13 May, 2022.

Dr. Hanuman Ram

- Received “Young Horticultural Scientist Award” from Society for Horticultural Research and Development at NAU, Navsari, Gujarat on 27 April 2022.
- Received best poster presentation award in National Conference *cum* 9<sup>th</sup> Rajasthan Science Congress held at SKNAU, Jobner during 15 -17 December, 2022.

### **Miscellaneous Award**

Dr R C Balai

- Got first position in *Hindi Nibandh lekhan pratiyogita* during *Hindi Pakhwada* 2022

Dr. R.K. Meena

- Received second position award in *Ashu Bhasan* competition on *Hindi Chetna Pakhawada* at ICAR-CIAH, Bikaner during 2022.

Dr. Anita Meena

- Awarded third prize in Hindi essay writing competition during *Hindi Pakhwada*, Septembe 15-30, 2022.

Dr. Kamlesh Kumar

- Received first prize in *Hindi Kavita Path*

*Pratiyogita in Hindi Pakhwada* organized and celebrated at ICAR-CIAH, Bikaner during 14-30 September 2022.

Dr. Hanuman Ram

- Received first prize award from ICAR-CIAH in *Hindi Shabda Lekhan Pratiyogita* during *Hindi Pakhwada* at ICAR-CIAH, Bikaner.

### Recognitions

Dr. S.K. Maheshwari

- Nominated as 'Member' in Editorial Board of "*Current Horticulture*" (Ghaziabad, U. P.)
- Nominated as Invigilator for conducting Limited Departmental Competitive Examination for the post of AAO on 07-05-2022.
- Acted as Chairman for selection of YP-I on 26-07-2022 and 03-09-2022.
- I nominated as External Examiner for practical of Course entitled: 'Agricultural Microbiology' of B. Sc. (Ag.) Part I Semester-II at SKRAU, Bikaner on 6-9-2022 to 08-09-2022.
- Acted as Member for considering cases under CAS promotion of scientists to examine scientific achievements on 06-10-2022.
- Nominated as Chairman for considering promotion case of Administrative Staff of this Institute on 18-11-2022.
- Nominated as Chairman for considering MACPS cases of Staff of this Institute on 30-11-2022.

Dr. A. K. Singh

- Acted as Convener in three days on campus training "Kitchen gardening: A component of nutritional security for tribal people" under TSP scheme during 21-23.03.2022 at CHES, Godhra.
- Acted as Course Director in one month on campus training on "Skill development training in horticultural crops" organized at CHES, Godhra held during June 01 to 30, 2022.
- Acted as Course Director in one month on campus training on "Crop improvement and production technology of semi-arid horticultural crops" organized at CHES, Godhra held during 28/11/2022 to 25/12/2022 for the students of College of Agriculture (Vaso Campus), AAU, Anand under RAWEP.
- Acted as a convener in 2<sup>nd</sup> Indian Horticulture Summit-2022 organized at NAU, Navsari (Gujarat.) during 27-29 April 2022.
- Acted as Chairman for Session 'Genetic

diversity and crop improvement' during 2<sup>nd</sup> Indian Horticulture Summit-2022 held at NAU, Navsari, 27-29 April, 2022.

Dr. V. V. Apparao

- Acted as Co-convener in 03 days on campus training on "Kitchen gardening: A component of nutritional security for tribal people" organized under TSP project at CHES, Godhra held during March 21 to 23, 2022.
- Acted as Course Co-Director in one month on campus training on "Skill development training in horticultural crops" organized at CHES, Godhra held during June 01 to 30, 2022.
- Acted as Course Director in 28 days on campus training on "Crop improvement and production technology of semi-arid horticultural crops" organized at CHES, Godhra held during Nov. 28 to Dec. 25, 2022 for the students of College of Agriculture (Vaso Campus), AAU, Anand under RAWEP.

Dr. D. S. Mishra

- Acted as Editor (PHT) for ISAH Indian Journal of Arid Horticulture (Indian Society for Arid Horticulture), Bikaner.
- Attended the Scientific Advisory Committee meeting of KVK, Dahod (AAU, Anand) as member on March 25, 2022.
- Worked as Chairman of Expert Committee for selection of players at CHES, Godhra to participate in ICAR Zonal Tournament (West Zone), held at ICAR-NRCC, Bikaner during 22-25.11.2022.
- Acted as member of constituted committee for the transfer of official/technical at CIAH & CHES.
- Acted as expert on 04. 08.2022 and also evaluated M.Sc. (Ag.) Horticulture (Fruit science) thesis of Ms Pooja Singh (Id. no. 49916) on "Studies on improving storability and quality of harvested guava fruits using chemicals" submitted to GBPUAT, Pantnagar.
- Evaluated M.Sc. (Horticulture) thesis of Ms Rathava Hemangini Mahendrabhai (Reg.No. 2020220027) on "Studies on characterization of different sapota varieties using molecular markers" on 18.08.2022 submitted to NAU, Navsari.
- Evaluated M.Sc. (Horticulture) thesis of Mr Gulshan Kumar (Roll.No. 21470) on "Characterization of promising mango hybrids using DUS descriptor and new hyper-variable SSR markers" on 23.08.2022 submitted to Post

Graduate School, IARI, New Delhi.

- Evaluated M.Sc. (Horticulture) thesis of Ms Amina Shukoor (Roll.No. 21468) on “Morpho-physio-biochemical and molecular characterization of maternal mango progenies” on 29.08.2022 submitted to Post Graduate School, IARI, New Delhi.
- Worked as reviewer of many journals of repute viz., Agriculture, Medicinal Plants, India Journal of Horticulture, International Journal of Agriculture Sciences and Acta Alimentaria during the year 2022.
- Acted as Co-convener in 03 days on campus training on “Kitchen gardening: A component of nutritional security for tribal people” organized under TSP project at CHES, Godhra held w.e.f. March 21 to 23, 2022.
- Acted as Course Co-Director in one month on campus training on “Skill development training in horticultural crops” organized at CHES, Godhra held during June 01 to 30, 2022.
- Acted as Course Director in 28 days on campus training on “Crop improvement and production technology of semi-arid horticultural crops” organized at CHES, Godhra held during Nov. 28 to Dec. 25, 2022 for the students of College of Agriculture (Vaso Campus), AAU, Anand under RAWEP.

Dr. D.K. Sarolia

- Served as chairman for *hindi pakhwada* committee organized during 16-30 September, 2022 at ICAR-CIAH, Bikaner (Rajbhasha//HP/2022/4435 dated 16 Sept., 2022).
- Nominated as member in bio-diversity board, Bikaner (endorsed CIAH No. 6900 dated 15/3/22)
- Nominated as invigilator in departmental promotion examination for the post of assistant administrative officer's paper on noting, drafting and precise writing at ICAR-CIAH, Bikaner on 05.05.2022 (10.30 AM to 1.0PM).
- Served as member in coordinator team in mega campaign on annadata devo bhava under Azadi ka Amrit Mahotsav and regional awareness campaign on natural and organic farming in arid horticulture crops (1-7 Feb., 22) organized at ICAR-CIAH, Bikaner
- Served as member secretary for career advancement scheme for promotion of scientists ICAR-CIAH, Bikaner.
- Served as course director for a winter school on

Commercialization of arid fruit and vegetable crops through modern approaches at ICAR-CIAH, Bikaner.

Dr. B.R. Choudhary

- Nominated for joint inspection of the project proposal on 'Hi-tech cultivation of cucumber under shade net house under NHB schemes' and conducted on 22-03-2022 in village-Daiya, Kolayat of Bikaner district.
- Acted as reviewer of a research paper of Indian Journal of Agricultural Sciences and Journal of Agriculture and Ecology.
- Acted as Associate Editor of Indian Journal of Arid Horticulture and Editor (Horticultural Sciences) of Journal of Agriculture and Ecology.
- Nominated for joint inspection of the project proposal (project code-08ARJ0006304) for 'Hi-tech cultivation of cucumber under polyhouse under the NHB schemes' and conducted on 08-06-2022 in village-Mankasar, Bajju of Bikaner district.

Dr. R.K.Meena

- Acted as editor for Indian Journal of Arid Horticulture published by Indian Society of Arid Horticulture, Bikaner.
- Acted as rapporteur in ICAR-AICRP on Arid Zone Fruits 26<sup>th</sup> Research Workers Meeting held at Acharya Narendra Dev Agriculture University, Kumarganj Ayodhya on 28-30 April 2022.

Dr. Ramesh Kumar

- Acted as Rapporteur in Plenary and Action Taken on recommendation sessions of ICAR-All India Coordinated Research Project on Arid Zone Fruits Annual Group Meeting 2022, held from 28 to 30 April, 2022 at ANDUAT, Ayodhya.
- Acted as Associate Editor of Indian Journal of Arid Horticulture published by Indian Society for Arid Horticulture, Bikaner.
- Acted as Rapporteur in the plenary session of “Consultation Meet on Date Palm Cultivation” organized at Date palm Research Station, SDAU, Mundra on 8<sup>th</sup> July, 2022.

Dr. Anita Meena

- Awarded third prize in Hindi essay writing competition during Hindi Pakhwada, September 15-30, 2022.
- Recognized as a reviewer for following journal “International journal of basic and applied

sciences: by Institute of scholar, Bangalore An ISO 9001:2015 during 2020.

- Recognized as professional member of Institute of Scholar Bangalore An ISO 9001:2015 and this membership is valid for lifetime, 2020.

Dr. L. P. Yadav

- Received certificate of honour and appreciation as speaker in Webinar on NHFS, organized by Helicus Group, Scientific Networks.
- Received certificate of excellence in reviewing from International Journal of Environment and Climate Change, 2022
- Acted as Rapporteur in National Symposium on 'Self-Reliant Coastal Agriculture' 2022 in Technical Session: 5 Conservation and improvement of plant genetic resources at ICAR-CCARI, Goa, during 11-13 May, 2022.
- Acted as Co-organizing secretary in three days on campus training "Kitchen gardening: A component of nutritional security for tribal people" under TSP scheme during 21-23.03.2022 at CHES, Godhra.
- Acted as Course Co-Director in one month on campus training on "Skill development training in horticultural crops" organized at CHES, Godhra held during June 01 to 30, 2022.
- Acted as Co-Course Director in one month on campus training on "Crop improvement and production technology of semi-arid horticultural crops" organized at CHES, Godhra held during Nov. 28 to Dec. 25, 2022 for the students of College of Agriculture (Vaso Campus), AAU, Anand under RAWEP.

Sh. J.S. Gora

- Acted as judges for the evaluation of poster paper in National Conference cum 9<sup>th</sup> Rajasthan Science Congress on "Harnessing Frontier Science and Technologies for Food, Nutrition, Health and Environmental Security" during 15-17 December 2022 at SKNAU, Jobner, Jaipur.
- Acted as external examiner in the UG practical examination on 09.03.2022 at Collage of Agriculture, Hanumangargh, Rajasthan.
- Acted as theory paper setter and examiner in paper FRS-111 (Fundamentals of Horticulture): 3 (2+1) for UG degree program in Agricultural University, Kota Rajasthan.
- Acted as paper setter and examiner in paper FLS 121 (Principles of Landscape and Architecture): 3 (2+1) for UG degree program in Agricultural University, Kota Rajasthan.
- Acted as paper setter and examiner in paper

HORT-111 (Fundamentals of Horticulture): 2 (1+1) for UG degree program in Agricultural University, Kota Rajasthan.

Dr. Kamlesh Kumar

- Received "Certificate of Excellence in Reviewing" from Journal of Environmental Biology, International Journal of Environment and Climate Change, Asian Journal of Microbiology and Biotechnology, Asian Journal of Research in Agriculture and Forestry, International Journal of Plant & Soil Science and Journal of Scientific Research and Reports during 2022.
- Recognized as "Potential Reviewer" for reviewing of several research articles of NAAS rated journals like Journal of Agriculture and Ecology, Food and Scientific reports, Journal of Environmental Biology, International Journal of Environment and Climate Change, Asian Journal of Microbiology and Biotechnology, Asian Journal of Research in Agriculture and Forestry, International Journal of Plant & Soil Science, Journal of Scientific Research and Reports during 2022.
- Recognized as "Paper Setter for Final Theory Examination" of subject 'Growth and Development in Horticultural Crops (FSC 508)' for M.Sc. (Hons.) Horticulture, Banda University of Agriculture and Technology, Banda-210001 (UP) during November 2022.
- Acted as "Rapporteur" in two sessions of All India Coordinated Research Project on Arid Fruits (AICRP-AZF) held during 28-30 April 2022.
- Recognized as "Paper Setter" for Final Theory Examination of subject 'Fundamentals of Horticulture' (HFS 111) for Banda University of Agriculture and Technology, Banda-210001 (UP) during February 2022.

Dr. Gangadhara K.

- Acted as organizing secretary in three days on campus training "Kitchen gardening: A component of nutritional security for tribal people" under TSP scheme during 21-23.03.2022 at CHES, Godhra.
- Acted as Course Co-Director in one month on campus training on "Skill development training in horticultural crops" organized at CHES, Godhra held w.e.f. June 01 to 30, 2022.
- Acted as Co-Course Director in one month on campus training on "Crop improvement and production technology of semi-arid

horticultural crops” organized at CHES, Godhra held w.e.f. 28/11/2022 to 25/12/2022 for the students of College of Agriculture (Vaso Campus), AAU, Anand under RAWEP.

- Acted as Rapporteur in Key Note Address Session-II: “Innovative technologies to augment the productivity of horticultural crops” in coastal region” in National Symposium on 'Self-Reliant Coastal Agriculture' 2022 in at ICAR-CCARI, Goa, during 11-13 May, 2022.
- Acted as Rapporteur in Technicals Session-3: “Augmenting productivity of horticultural

crops” in coastal region” in National Symposium on 'Self-Reliant Coastal Agriculture' 2022 in at ICAR-CCARI, Goa, during 11-13 May, 2022.

Dr. Hanuman Ram

- Acted as Co-cordinator in five days training programme on “Extension Strategies for Promotion of Climate Resilient Horticultural Technologies in Hot Arid and Semi-arid regions” was organized during 11.10.2022 to 15.10.2022.



## 9. PUBLICATIONS

### A) Research paper

- Berwal, M.K., Ram, C., Gurjar, P.S., Gora, J.S., Kumar, R., Verma, A.K., Singh, D., Basile, B., Rouphael, Y. and Kumar, P. 2022. The bioactive compounds and fatty acid profile of bitter apple seed oil obtained in hot, arid environments. *Horticulturae*, 8(3): 259. DOI: <https://doi.org/10.3390/horticulturae8030259>.
- Chahar S., Jakhar M.L., Gothwal D.K., Kumar M., Arsode P.B., Kumar P., Dahiphale A.V. 2022. The study of salinity stress on the different genotypes of Taramira (*Eruca sativa* mill.). *Agricultural Mechanization in Asia, Africa and Latin America*. 53(5): 7793-7798.
- Chahar S., Jakhar M.L., Gothwal D.K., Kumar M., Arsode P.B., Kumar P. and Dahiphale A.V. 2022. The study of genotypic and phenotypic coefficient of variations, heritability and genetic advance of seedling characteristics of Taramira (*Eruca sativa* mill.) under Salt Stress Conditions. *Agricultural Mechanization in Asia, Africa & Latin America* 53(5): 7787-91.
- Choudhary, B.R., Berwal, M.K. and Saroj, P.L. 2022. YF 5-2-7 (IC-0633085; INGR20117), a watermelon (*Citrullus lanatus*) germplasm with saffron coloured flesh and high carotenoid content, non-lobed (entire) leaves. *Indian Journal Plant Genetic Resources*, 35(1): 145.
- Datt, R.M., Kukreja V., Sharma A., Kumawat, K.L. 2022. Predicting Apple Yield Losses as Influenced by Weather Driven Time of Arrival of Phenological Stages and Soil Quality in Temperate Regions of North-West Himalayas. *Journal of the Indian Society of Soil Science*, 70(4): 441-445.
- Gora, J. S., Kumara, R., Sharma, B. D., Ram, C., Berwal, M. K., Singh, D., Bana, R. S. and Kumar, P. 2022. Performance evaluation of Fremont mandarin on different rootstocks under the hot arid environment of India. *South African Journal of Botany*, 142(3):124-133. <https://doi.org/10.1016/j.sajb.2021.08.037>.
- Gupta, N., Rai, R., Islam, S., Meena, R.P. and Baranwal, V.K. 2023. Production of polyclonal antibodies against leek yellow stripe virus (LYSV) coat protein expressed in *Escherichia coli* and its application in serological diagnostics. *Letters in Applied Microbiology*, 76(2): ovac064. DOI: <https://doi.org/10.1093/lambio/ovac064>
- Gurjar, P.S., Singh, S.R., Verma, A.K. and Rajan, S. 2022. Reduction of browning in minimally processed fresh-cut lettuce. *Indian Journal of Horticulture*, 79(2): 231-236.
- Haldhar, S.M., Berwal, M.K., Bhargava, R., Saroj, P.L., Kumar, R., Gora, J.S., Samadia, D.K., Singh, D., El-Nakhel, C., Rouphael, Y. and Kumar, P. 2022. Bitter melon novel bioformulation “Thar Jaivik 41 EC”: characterization and bio-efficacy assessment as a biopesticide on horticulture crops. *Agriculture*, 13(1): 19. DOI: [doi.org/10.3390/agriculture13010019](https://doi.org/10.3390/agriculture13010019).
- Haldhar, S.M., Kumar, R., Corrado, G., Berwal, M.K., Gora, J.S., Thaochan, N., Samadia, D.K., Hussain, T., Rouphael, Y., Kumar, P. and Basile, B. 2022. A field screening of a pomegranate (*Punica granatum*) ex-situ germplasm collection for resistance against the false spider mite (*Tenuipalpus punicae*). *Agriculture*, 12(10): 1686. DOI: <https://doi.org/10.3390/agriculture12101686>.
- Haldhar, S.M., Singh, A.K., Singh, D., Berwal, M.K., Gora, J.S., Kumar, R. and Sarolia, D.K. 2022. Endogenous effect of *Syzygium cumini* genotypes on incidence of fruit borers, *Meridarchis scyroides* and *Dudua aprobola*. *Journal of Environmental Biology*, 43(4): 585-592. DOI: <http://doi.org/10.22438/jeb/43/4/MRN-2057>.
- Janani, P., Adiga, J., BKalaivanan, D.M., RKRejani, R. And Yadukumar, N. 2022. Performance of high yielding varieties of cashew (*Anacardium occidentale* L.) under different planting densities. *Applied ecology and environmental research*, 20(3): 2381-2392.
- Kesawat, M.S., Kherawat, B.S., Ram, C., Singh, A., Dey, P., Gora, J.S., Misra, N., Chung, S.M. and Kumar, M. 2022. Genome-Wide Identification and expression profiling of aconitase gene family members reveals their roles in plant development and adaptation to

- diverse stress in *Triticum aestivum* L. *Plants*, 11(24): 3475.
- Kesawat, M.S., Kherawat, B.S., Singh, A., Dey, P., Routray, S., Mohapatra, C., Saha, D., Ram, C., Siddique, K.H., Kumar, A. and Gupta, R. 2022. Genome-wide analysis and characterization of the proline-rich extensin-like receptor kinases (PERKs) gene family reveals their role in different developmental stages and stress conditions in wheat (*Triticum aestivum* L.). *Plants*, 11(4): 496.
  - Khajuria, S., Rai A. K. and Lata, K. 2022. Impact of frontline demonstrations in transfer of technology for management of paddy leaf folder. *Gujarat Journal of Extension Education* 34(2): 124-127.
  - Krishna, H., Sarolia, D., Parashar, A. and Kumar, L. 2022. Descriptors for characterization and evaluation of indian jujube (*Ziziphus mauritiana* Lamk.) germplasm for utilization in crop improvement. *Fruits*, 77(2): 1-10. DOI: <https://doi.org/10.17660/th2022/009>.
  - Kumar K., Sarolia D.K., Saroj, P.L., Samadia D.K. and Singh D. 2022. Standardization of seed, rootstock and plant standards of lasoda (*Cordia myxa* L.) for commercial orcharding in India. *Journal of Environmental Biology*, 43(2): 267-275.
  - Kumar M., Sandhya, Kumar P., Gaurav A., Soni R.K. and Meena D. 2022. Principal Component Analysis (PCA) for assessment of genetic diversity in rice under Humid South-Eastern plain of Rajasthan. *Agricultural Mechanization in Asia*. 53(02): 5785-93.
  - Kumar P., Singh H., Choudhary M., Kumar D. and Kumar M. 2022. Genetic stability analysis of bread wheat hybrids and parents under semi-arid eastern plains of Rajasthan. *Journal of Environmental Biology*, 43: 668-676.
  - Kumar S., Lamba M. and Yadav L.P. 2022. Characterization of coriander (*Coriandrum sativum*) genotypes based on floral traits. *Current Horticulture*, 10(2): 56-58.
  - Kumar, R., Rai, A. K. and Khajuria, S. 2022. Impact of planting distance on yield of cauliflower under semi-arid conditions *Gujarat Journal of Extension Education* 32(1): 223-227.
  - Maheshwari, S.K., Choudhary, B.R., Haldhar, S.M. and Berwal, M.K. 2022. Effectiveness of botanicals, inorganic salts and fungicide against Fusarium wilt of muskmelon under hot arid region of Rajasthan. *Journal of Agriculture and Ecology*, 14: 21-25.
  - Meena, M.K., Dogra, I., Sudarsan, Y., Sharma, A.K., Singh, D., Sharma, V. and Ram, C., 2022. Identification and characterization of CAT1 gene during drought stress in moth bean [*Vigna aconitifolia* (Jacq.) Marechal]. *Journal of Agriculture and Ecology*, 14: 164-172.
  - Meena, R.P., Kadam, V.A., Minipara, D., Kalariya, K.A. and Saran, P.L. 2022. Characterization of a cross genera fungus, *Exserohilum rostratum* causes leaf spot disease of *Tinospora cordifolia* (Willd.) Miers. *Medicinal Plants-International Journal of Phytomedicines and Related Industries*, 14(2): 276-283. DOI: <https://doi: 10.5958/0975-6892.2022.00032.6>
  - Meena, R.P., Minipara, D., Choyal, P., Kalariya, K.A., Saran, P.L. and Roy, S. 2022. Detection and molecular characterization of cucumber mosaic virus infecting *Tylophora indica* (Burm. f. Merrill). *Journal of Applied Research on Medicinal and Aromatic Plants*, 30: 100391. DOI: <https://doi.org/10.1016/j.jarmap.2022.100391>
  - Mehta H., Kumar P., Rathore A.C., Kaushal R. and Gupta A.K., 2022. Evaluation of *Grewia optiva* clones for fodder yield under North Western Himalayas conditions. *Journal of Sustainable Forestry*, 1-12, DOI: 10.1080/10549811.2022.2045502
  - Mishra, D.S., Berwal, M.K., Singh A., Singh, A.K., Appa Rao, V.V., Yadav, V. and Sharma, B.D. 2022. Phenotypic diversity for fruit quality traits and bioactive compounds in red-fleshed guava: Insights from multivariate analyses and machine learning algorithms. *South African Journal of Botany*, 149:591-603.
  - Parihar M., Rakshit A., Rana K., Tiwari G., Jatav S.S. and Ram H. 2022. Evaluation of various substrates for mycorrhizal inoculum production. *Indian Journal of Agricultural Sciences* 92(1): 315.
  - Ram, C., Danish, S., Kesawat, M.S., Panwar, B.S., Verma, M., Arya, L., Yadav, S. and Sharma, V. 2022. Genome-wide comprehensive characterization and expression analysis of TLP gene family revealed its responses to hormonal and abiotic stresses in watermelon (*Citrullus lanatus*). *Gene*, 844: 146818.
  - Raturi, G., Kumawat, S., Mandlik, R.,

- Duhan, D., Thakral, V., Sudhakaran, S., Ram, C., Sonah, H. and Deshmukh, R. 2022. Deciphering the role of aquaporins under different abiotic stress conditions in watermelon (*Citrullus lanatus*). *Journal of Plant Growth Regulation*, pp.1-13. DOI: <https://doi.org/10.1007/s00344-022-10776-1>.
- Sandhya, Mukul, Kumar M., Kumar P., Gaurav A., Meena D. 2022. Assessment of Principal Component Analysis and Genetic diversity among linseed (*Linum usitatissimum* L.) germplasm under Humid South Eastern plain of Rajasthan. *Agricultural Mechanization in Asia*. 53(02): 5802-5818.
  - Sarolia, D.K., Saroj, P.L., Reddy, S.V.R., Singh, D. and Meena, A. 2022. Influence of weather variables on different phenophases of mulberry. *Indian Journal of Horticulture*, 79(2): 215-220.
  - Sashi, Garhwal, O.P., Choudhary M.R., Bairwa L.N., Kumawat K.L., Kumar P., Basile B., Corrado G., Roupheal Y. and Gora J.S. 2022. Effects of Time of Pruning and Plant Bio-Regulators on the Growth, Yield, Fruit Quality, and Post-Harvest Losses of Ber (*Ziziphus mauritiana*). *Horticulturae*, 8(9): 809. DOI: 10.3390/horticulturae8090809
  - Shreenath Y.S., Nabi S.U., Madhu G.S., Kumawat K.L. and Rao G.P. 2022. Identification and multilocus gene characterization of phytoplasmas associated with sweet cherry in India. *3 Biotech*, 12(11): 291. DOI: 10.1007/s13205-022-03357-2
  - Tomar J.M.S., Kumar P., Gupta A.K., Kaushal R. and Mehta H. 2022. Performance of two aromatic grasses grown in association with mulberry trees on degraded land in the North-Western Himalayan foothills. *Biological Agriculture & Horticulture*. DOI: 10.1080/01448765.2022.2115399
  - Yadav, L. P., Gangdhara, K., Apparao, V.V. 2022. Evaluation of drumstick variety Thar Harsha under rainfed semi-arid conditions for growth, yield and quality along with antioxidant potentiality and nutrient content. *South African Journal of Botany*, 148, 112-122.
- b) Scientific Review**
- Chaudhari G.V., Hedau N.K., Ram H., Khade Y., Kant L. and Khar A. 2022. Garlic: retrospect, status quo and dimensions. *Genetic Resources and Crop Evolution* 69: 26452660.
  - Choudhary B.R., Berwal M.K., Ram H., Choudhary M.K. and Singh D. 2022. *Momordica balsamina* L.: An unexploited vegetable crop rich in medicinal and nutritional properties. *Journal of Agriculture and Ecology*, 14: 84-92.
  - Gora J.S., Ram C., Kumar P., Choudhary M. and Haldhar S.M. 2022. Polyploid rootstocks in citrus for mitigation of biotic and abiotic stresses: A review. *Journal of Agriculture and ecology*. 13, 1-19 <http://dx.doi.org/10.53911/JAE.2022.13101>.
  - Gupta A.K., Gurjar P.S., Beer K., Pongener A., Ravi S.C., Singh S., Verma A., Singh A., Thakur M., Tripathy S. and Verma D.K., 2022. A review on valorization of different byproducts of mango (*Mangifera indica* L.) for functional food and human health. *Food Bioscience*, 48: 101783.
  - Gupta M., Kaur Y., Kumar H., Kumar P., Choudhary J., Kumar P., Aggarwal S.K., Yadav S. and Choudhary M. 2022. Molecular Markers in Maize Improvement: A Review. *Acta Scientific Agriculture*, 6(9): 55-70.
  - Gurjar P.S., Killadi B., Pareek P.K. and Hada T.S. 2022. Application of melatonin in maintaining post-harvest quality of fruits and vegetables: A review. *Agricultural Reviews*, 43(2): 193-198.
  - Javed T., Indu I Singhal R., Shabbir R., Kumar P., Shah A.N., Jinger D., et al. 2022. Recent Advances in Agronomic and Physio-molecular Approaches for Improving Nitrogen Use Efficiency in Crop Plants. *Frontiers in Plant Science*, 13. DOI: 10.3389/fpls.2022.877544
  - Kumar R.R., Singh S.P., Rai G.K., Krishnan V., Berwal M.K., Goswami S., Vinutha T., Mishra G.P., Satyavathi C.T., Singh B. and Praveen S. 2022. Iron and Zinc at a cross-road: a trade-off between micronutrients and anti-nutritional factors in pearl millet flour for enhancing the bioavailability. *Journal of Food Composition and Analysis*, p.104591. DOI: <https://doi.org/10.1016/j.jfca.2022.104591>.
  - Kumar S., Bairwa D.S., Kumar K., Yadav R.K. and Yadav L.P. 2022. Climate regulation in protected structures: A review. *Journal of Agriculture and Ecology*, 13: 20-34
  - Meena V.S., Gora J.S., Singh A., Ram C., Meena N.K., Roupheal Y., Basile B. and Kumar P. 2022. Underutilized fruit crops of Indian arid and semi-arid regions: Importance, conservation and utilization strategies.

- Horticulturae*, 8(2): 171. <https://doi.org/10.3390/horticulturae8020171>.
- Rai G.K., Kumar P., Choudhary S.M., Kosser R., Khanday D.M., Choudhary S., Kumar B., Magotra I., Kumar R.R., Ram C. and Roupael Y. 2022. Biomimetic Strategies for Developing Abiotic Stress-Tolerant Tomato Cultivars: An Overview. *Plants*, 12(1): 86.
  - Saha D., Choyal P., Mishra U.N., Dey P., Bose B., Prathibha M.D., Gupta N.K., Mehta B.K., Kumar P., Pandey S., Chauhan J. and Singhal R.K. 2022. Drought stress responses and inducing tolerance by seed priming approach in plants. *Plant Stress*, 4 (100066). doi: <https://doi.org/10.1016/j.stress.2022.100066>.
  - Samadia D.K., Haldhar S.M., Verma A.K., Gurjar P.S., Berwal M.K., Gora J.S., Kumar R. and Ram H. 2022. Khejri (*Prosopis cineraria*) research for horticultural harnessing and environmental services: an appraisal. *Journal of Agriculture and Ecology*, 12: 1-26.
  - Saroj P.L., Kumar, K., Kumawat K.L., Sarolia D.K. and Meena R.K. 2021 (Published in 2022). Significance of pollinizers in arid fruit culture: A review. *Progressive Horticulture*, 53(2):123-141.
  - Saroj P.L., Sarolia D.K. and Sharma B.D. 2022. Seventy-five years of research and development in arid fruit crops. *International Journal of Innovative Horticulture*, 11(1): 24-35. DOI: 10.5958/2582-2527.2022.00003.3
  - Sarolia D.K., Meena R.K., Kumawat K.L., Choudhary M.K. and Singh D.K., 2021. Raising of quality saplings of arid horticultural crops: a review. *Journal of Agriculture and Ecology*, 11: 1-14.
  - Singh S., Singh A.K., Mishra D.S., Singh G.P. and Sharma B.D. 2022. Advances in research in *jamun* (*Syzygium cuminii*): A review. *Current Horticulture*, 10(1): 8-13.
  - Singhal R.K., Fahad S., Kumar P., Choyal P., Javed T., Jinger D., Singh P., Saha D., Prathibha M.D., Bose B., Akash H., Gupta N.K., et al. 2022. Beneficial elements: New Players in improving nutrient use efficiency and abiotic stress tolerance. *Plant Growth Regulation*, 5:129. <https://doi.org/10.1007/s10725-022-00843-8>
- c) **Books, compendium, proceedings, bulletins, manual & folders**
- Book:**
- हनुमान राम, मुकेश कुमार बेरवाल, जगन सिंह गोरा, सरिता यादव, अशोक बूरा, मीनू पूनिया, भारत सिंह घणघस, वेद प्रकाश चहल 2022 “न्यूट्री फार्म: पोषण से सतत विकास की ओर”. भाअनुप – केंद्रीय भैंस अनुसन्धान संस्थान; हिसार भाअनुप – केंद्रीय शुष्क बागवानी संस्थान, बीकानेर. पेज 1-100
  - डॉ. दिलीप कुमार समादिया (2022) खेजड़ी – बागवानी आधारित फसल सुधार एवं तकनीकी विकास। हिन्दी पुस्तक, भाकृअनुप-केंद्रीय शुष्क बागवानी संस्थान, बीकानेर। (आईएसबीएन : 978-81-956916-0-9) पेज : 1-115.
  - Choudhary B.R., Jatav M.K. and Maheshwari S.K. 2022. Seed production of arid vegetables (H). Technical manual published by ICAR-CIAH, Bikaner: pp.1-119.
  - Kumar R., Singh, S. Singh, J. and Sigh, A. K. 2022. Concise Horticulture. Brillion Publishing, New Delhi, pp.1-491, ISBN: 978-93-90757-37-4, eISBN: 978-9390757-45-9.
  - Manivel P., Meena R.P., Suganthy M., Janakiram T. and Chaudhary V. 2022 Pest and Diseases of Medicinal Plants. Westville Publishing House, new Delhi.
  - Mishra, D.S., Singh, A.K. and Sharma, B.D. 2022. Strategies for developing high density planting in arid fruit crops for efficient use of water and nutrients. Compendium of lectures: ICAR sponsored Winter School on 'Advances in Irrigation Technologies and Nutrient Management in Arid Horticulture Crops', SKRAU, Bikaner, 08-28, March, 2022, pp.210-223.
  - Singh, B., Dutt, S., Tomar, B. S., Ranjan, J. K., Singh, A. K., Singh, G. J., Singh, J., Lata, S., Lyngdoh, Y. A., Jain, R., Ranjan, P., Namita and Panwar, S. 2022. Book Of Abstracts, 2<sup>nd</sup> Indian Horticulture Summit-2022 on Horticulture for Prosperity and Health Security, 27-29 April 2022 at the Navsari Agricultural University, Navsari, Gujarat organized by SHRD, Ghaziabad, U. P., India
  - Singh, B., Dutt, S., Tomar, B. S., Ranjan, J. K., Singh, A. K., Singh, G. J., Singh, J., Lata, S., Lyngdoh, Y. A., Jain, R., Ranjan, P., Namita and Panwar, S. 2022. Souvenir, 2<sup>nd</sup> Indian Horticulture Summit-2022 on Horticulture for Prosperity and Health Security, 27-29 April 2022 at the Navsari Agricultural University, Navsari, Gujarat, organized by SHRD, Ghaziabad, U. P., India.
- Bulletin:**
- जगन सिंह गोरा, रमेश कुमार, अनिल कुमार एवं वेद प्रकाश चहल (2022). फल फूल. तकनीकी पुस्तिका. प्रकाशकरु भाअनुप-केंद्रीय भैंस अनुसंधान संस्थान, हिसार, हरियाणा-125 001. पृष्ठ संख्या 1-74.
  - रामप्रसन्न मीना, कुलदीपसिंह कालरिया, परमेश्वर लाल सारन, (2022) गुडमार “मधुनाशिनी” की खेती, भाअनुप-औषधीय एवं

संगंधीय पादप अनुसंधान निदेशालय बोरीआवी- 387310, आणंद, गुजरात.

d) **Book Chapter**

- हनुमान राम. न्यूट्री (पोषण) फार्म के लिये सब्जी-नर्सरी प्रबंधन. न्यूट्री फार्म: पोषण से सतत विकास की ओर. वर्ष 2022 पृष्ठ नंबर 3 से 6
- राजेश्वर सनोदिया, महेंद्र कुमार चौधरी एवं हनुमान राम. न्यूट्री (पोषण) फार्म में यंत्रों तथा उपकरणों का उपयोग. न्यूट्री फार्म: पोषण से सतत विकास की ओर. वर्ष 2022 पृष्ठ नंबर 7 से 11
- महेन्द्र कुमार चौधरी, पी एस गुर्जर एवं हनुमान राम. न्यूट्री (पोषण) फार्म की स्थापना. न्यूट्री फार्म: पोषण से सतत विकास की ओर. वर्ष 2022 पृष्ठ नंबर 56 से 59
- नरेन्द्र चौधरी, एस लाल, एन के मीणा, आर डी मीणा, एम के चौधरी एवं हनुमान राम सौंफ की जैविक उत्पादन प्रणाली. न्यूट्री फार्म: पोषण से सतत विकास की ओर वर्ष 2022 पृष्ठ नंबर 60 से 67
- किशन लाल कुमावत, हनुमान राम, पवन कुमार और महेन्द्र कुमार चौधरी. न्यूट्री (पोषण) फार्म में गुणवत्तायुक्त उच्चतम फल उत्पादन हेतु छत्र प्रबंधन. न्यूट्री फार्म: पोषण से सतत विकास की ओर. वर्ष 2022 पृष्ठ नंबर 68 से 71
- Anita Meena, J.K. Meena, Ramyashree DGS, Chetram and S.M. Haldhar. Incidence of pest and disease in dryland horticulture with climate. ISBN: 978-81-7622-491-8, Biotech Book, 4762-63/23, Ansari Road, Daryaganj, New Delhi-110002, Environmental Biology.
- Anita Meena, Nirupama Singh and Jitendra Kumar Meena. Importance of Information Technology in Increasing Agricultural Income, Just Agriculture Vol. 3 Issue-2, October 2022, (e-ISSN: 2582-8223). Page no.- 1-5.
- Chet Ram and P.L. Saroj. Application of omics in arid fruit crops: present status, challenges and future perspectives. In: Omics in horticultural crops, Rout G., Peter K. V. (eds.), Elsevier. 2022. pp. 55-74.
- D.K. Sarolia, R.K. Meena, R. Kumar, D.P. Singh, J.S. Gora. Mass Multiplication of quality planting material in Horticulture crops. In Dryland Horticulture (Ed.) Jatav, M.K., Saroj, P.L. and Sharma, B.D. New India Publishing Agency, New Delhi. 2022. pp.131-140 (ISBN: 978-1-032-15837-2)
- Kajal Nagre, Nirupama Singh, Chandrika Ghoshal, Anita Meena and, S.P. Singh. Omics Strategies to Combat Abiotic Stress in Pearl Millet, Astha foundation in GRISAASan Edited Book (Volume-2) ISBN: 978-81-958010-2-2 Published by: Astha Foundation, Meerut (U.P.) India, Page no. 38-44.
- M. Choudhary, P. Kumar, P. Kumar, S. Sheoran, R.U. Zunjare and B.S. Jat. 2022. Molecular breeding for drought and heat stress in maize: Revisiting the progress and achievements. In book: QTL Mapping in Crop Improvement Chapter 4 (Elsevier pub.) pp. 57-74. DOI:10.1016/B978-0-323-85243-2.00009-X
- M. Parihar, M.K. Chitara, H. Ram, A. Kumari, G. Tiwari, K. Rana, B. Gorain, U. Kumar, J.K. Bisht and L. Kant. Role of AM fungi in growth promotion of high-value crops. New and Future Developments in Microbial Biotechnology and Bioengineering Sustainable Agriculture: Advances in Microbe-based Biostimulants, Elsevier. 2022. pp. 121-144. doi.org/10.1016/B978-0-323-85577-8.00018-4
- R. Kumar, P.L. Saroj, B.D. Sharma and R.K. Meena. Flower regulation in Pomegranate (*Punica granatum* L. under hot arid climate. Dryland Horticulture (Ed.) Jatav, M.K., Saroj, P.L. and Sharma, B.D. New India Publishing Agency, New Delhi. 2022. pp. 277-288 (ISBN: 978-1-032-15837-2)
- R.K. Meena, D.K. Sarolia, S.V.R. Reddy, R. Kumar, C. Ram and A. Meena. Diagnosis and Management of Physiological Disorders in Arid Fruit Crops. In Dryland Horticulture. (Ed.) Jatav, M.K., Saroj, P.L. and Sharma, B.D. New India Publishing Agency, New Delhi. 2022. pp. 327-338. (ISBN: 978-1-032-15837-2)
- R.K. Meena, D.K. Sarolia, V.S. Reddy and K. Hare. Ber production technology in dry and arid region. In; Natural resource management in horticultural crops (Edited by Subhra Saikat Roy et al.), Today and tomorrow's Printers & Publishers, New Delhi. 2022. pp. 123-147.
- R.P. Meena and K. Mandal. 2022. "Soft rot disease of Aloe vera: Etiology, Characterization of associated pathogens and management strategies" at Sri Karan Narendra Agriculture University, Jobner, Jaipur, Rajasthan, India in IPS 8<sup>th</sup> International Conference (hybrid mode) on "Plant Pathology: Retrospect and Prospects" during March 23-26, 2022.
- R.S. Singh and R.K. Meena. Date palm cultivation in arid ecosystem. Dryland Horticulture (Ed.) Jatav, M.K., Saroj, P.L. and Sharma, B.D. New India Publishing Agency, New Delhi. 2022. pp. 255-276 (ISBN: 978-1-032-15837-2)
- S.K. Maheshwari, A.K. Verma, and S. Khajuria. Muskmelon (*Cucumis melo* L.): Key Diseases and their Management. In: Diseases of Horticultural Crops: Diagnosis and Management, Fruit Crops- Vol. 1 (Eds:

- Srivastava, J. N. and Singh, A. K.), Apple Academic Press, Inc., USA. 2022. ISBN: 978-1-77188-989-6 (hbk), pp. 377-391.
- S.K. Maheshwari, H. Krishna and L. Kumar. *Aonla (Emblica officinalis Gaertn.): Key Diseases and their Management. In: Diseases of Horticultural Crops: Diagnosis and Management, Fruit Crops- Vol. 1 (Eds: Srivastava, J. N. and Singh, A. K.), Apple Academic Press, Inc., USA. 2022. ISBN: 978-1-77188-989-6 (hbk), pp. 61-70.*
  - S.K. Maheshwari, H. Krishna and S. Khajuria. *Ber (Ziziphus mauritiana Lamk.): Key diseases and their management. In: Diseases of Horticultural Crops: Diagnosis and Management, Fruit Crops- Vol. 1 (Eds: Srivastava, J. N. and Singh, A. K.), Apple Academic Press, Inc., USA. 2022. ISBN: 978-1-77188-989-6 (hbk), pp. 141-153.*
  - S.K. Maheshwari, R. Devi, B.R. Choudhary, P.P. Singh and B.R. Khatri. *Watermelon [Citrullus lanatus (Thunb) Mansf.]: Major Diseases and their Management. In: Diseases of Horticultural Crops: Diagnosis and Management, Fruit Crops- Vol. 1 (Eds: Srivastava, J. N. and Singh, A. K.), Apple Academic Press, Inc., USA. 2022. ISBN: 978-1-77188-989-6 (hbk), pp. 417-432.*
  - S.R. Meena, P.L. Saroj, M.K. Jatav, R.K. Meena and R.C. Balai. *Socio-Economic Importance of Cucurbitaceous Vegetables in Hot arid Zones of India. In Dryland Horticulture (Ed.) Jatav, M.K., Saroj, P.L. and Sharma, B.D. New India Publishing Agency, New Delhi. 2022. pp. 617-630 (ISBN: 978-1-032-15837-2)*
  - V.A. Parthasarathy, A.K. Singh, S. Singh, D.S. Mishra and V. Yadav. *Bael. In: Fruits: Tropical and Subtropica, Vol-3 (Parthasarathy et al. eds.). Daya Publishing House (Astral International Pvt. Ltd.), New Delhi. 2022. pp. 571-608.*
- e) **Folders:**
- Yadav, L.P., Gangadhara K, Apparao, V.V., Singh, S., Saroj, P.L., More, T.A. and B.D. Sharma. 2022. *Thar Anant: lycopen rich heat tolerant variety of tomato. Folder published by ICAR-CIAH, Bikaner (Raj). 1-6.*
- f) **Popular Articles**
- कमलेश कुमार एवं डी. के. समादिया 2020-21 (2022 में प्रकाशित) केर: मरुस्थलीय पारिस्थितिकी तंत्र की एक बहुउद्देशीय झाड़ी मरु बागवाणी राजभाषा पत्रिका अंक 15, पृष्ठ 41-42
  - कमलेश कुमार 2020-21 (2022 में प्रकाशित) भारतीय संसति में पेड़- पौधों एवं पर्यावरण का महत्व मरु बागवाणी राजभाषा पत्रिका अंक 15, पृष्ठ 10-13
  - कमलेश कुमार, एस. एम. हलधर, पी.एस. गुर्जर और चेत राम (2022) लसोड़ा की खेती. फल फूल. किसान खेती, नवाचार, संसाधन, विज्ञान और प्रौद्योगिकी. परियोजना, भारतीय षि अनुसंधान परिषद के अंतर्गत. प्रथम संस्करण, पृष्ठ 47-49
  - कुमार, आर., लता, के., खद्दा, बी. एस., राय, ए. के. एवं खजुरिया, एस. 2022. अर्ध-शुष्क क्षेत्रों में बाग कि स्थापना फल फूल जुलाई - अगस्त, पेज संख्या 34-36.
  - कुमार, आर., लता, के., राय, ए. के., खजुरिया, एस. एवं खद्दा, बी. एस. 2022. पोषण सुरक्षा के लिए स्वार्ड बीन की खेती फल फूल जनवरी-फरवरी, पेज संख्या 34-35.
  - कुमार, आर., लता, के., राय, ए. के., खजुरिया, एस. एवं खद्दा, बी. एस. 2022. पंक्ति प्रणाली से फूलगोभी की खेती फल फूल सितम्बर अक्टूबर, पेज संख्या 26-27.
  - निर्मल कुमार हेडाऊ, चौधरी गणेश वासुदेव और हनुमान राम. बेमौसम में उगाएं वी.एल. सब्जी मटर-15 फल फूल मार्च-अप्रैल, 2022, 14-15
  - हरे ष्णा, अरविंद कुमार सिंह और रामकेश मीना. 2022 मई जून में किए जाने वाले बागवानी कार्य, फल फूल, संख्या. 19-24.
  - पी. एल. सरोज एवं कमलेश कुमार 2020-21 (2022 में प्रकाशित) बेर एवं सेब फल की तुलनात्मक विशेषतायें मरु बागवाणी राजभाषा पत्रिका अंक 15, पृष्ठ 21-23
  - पवन कुमार, महेंद्र कुमार चौधरी, धुरेंद्र सिंह 2021. बदलते जलवायु परिश्य में सतत फल उत्पादन: वर्तमान समय की आवश्यकता. मरु बागवानी राजभाषा पत्रिका, पेज नं. 31-34.
  - पवन कुमार, रमेश कुमार, जगन सिंह गोरा, चेताराम, रामकेश मीना, मुकेश कुमार बेरवाल एवं दीपक कुमार सरोलिया 2022. बेल की खेती छ फल फुल छ किसान षि नवाचार संसाधन विज्ञान और प्रौद्योगिकी परियोजना, पेज नं. 42-46
  - पवन सिंह गुर्जर और कमलेश कुमार 2020-21 (2022 में प्रकाशित) मरुधरा के कल्पवृक्ष खेजड़ी की उपयोगिता मरु बागवाणी राजभाषा पत्रिका अंक 15, पृष्ठ 24-26
  - रमेश कुमार, जगन सिंह गोरा, मुकेश कुमार बेरवाल, पवन कुमार एवं श्रवण एम् हलधर 2022. किन्नौ की खेती. फल फूल, तकनीकी पुस्तिका, प्रकाशक: भाअनुप-केंद्रीय भैंस अनुसंधान संस्थान, हिसार, हरियाणा, पृष्ठ संख्या 9-14.
  - रमेश कुमार, जगन सिंह गोरा, चेताराम, पवन कुमार, महेंद्र कुमार चौधरी एवं मुकेश कुमार बेरवाल 2022. अनार की खेती. फल फूल, तकनीकी पुस्तिका, प्रकाशक: भाअनुप-केंद्रीय भैंस अनुसंधान संस्थान, हिसार, हरियाणा, पृष्ठ संख्या 23-28.
  - रमेश कुमार, जगनसिंह गोरा, चेताराम, पवन कुमार,

- पवनसिंह गुर्जर एवं महेंद्र कुमार चौधरी 2022. आंवले की खेती. फल फूल, तकनीकी पुस्तिका, प्रकाशक: भाअनुप-केंद्रीय भैस अनुसंधान संस्थान, हिसार, हरियाणा, पृष्ठ संख्या 1-4.
- राय, ए. के., कुमार, आर. खजुरिया, एस. एवं लता, के. 2022. ग्रीष्म ऋतु में तिल एक लाभकारी खेती अंक: 2 पेज न. 8-9
  - रामकेश मीना, आर एस सिंह, पवन सिंह गुर्जर और एव पवन पारीक. 2021. थार रेगिस्तान में खजूर की वैज्ञानिक खेती, मरु बागवानी राजभाषा पत्रिका, केंद्रीय शुष्क बागवानी संख्या. 19-24.
  - अकिंत सिंह, शिवराज कुमार वर्मा एवं कमलेश कुमार 2020-21 (2022 में प्रकाशित) ड्रैगन फ्रूट: शुष्क क्षेत्र हेतु एक विदेशी फल मरु बागवानी राजभाषा पत्रिका अंक 15, पृष्ठ 73-75
  - आर के मीना, दीपक कुमार सरोलिया एव पवन पारीक 2021. गर्म-शुष्क जलवायु में अनार की उपयुक्त किस्म का मूल्यांकन, मरु बागवानी राजभाषा पत्रिका, केंद्रीय शुष्क बागवानी संख्या. 35-37.
  - अजय कुमार वर्मा, डी.के. समादिया, पी.एस. गुर्जर एवं हनुमान राम. शुष्क क्षेत्र में सब्जी हेतु ग्वारफली की उत्पादन तकनीकी 2020-21, 50-52.
  - A.K. Rai, S. Khajuria, K. Lata and B. S. Khadda. 2022. Single Cross Hybrid Maize Seed production Intensive Agriculture, Ministry of Agriculture IASRI Campus, Krishi Vistar Bhavan, Pusa New Delhi April - June pp. 9-13
  - Anita Meena, Neerupama Singh, Jitendra Kumar, Madhuri Meena and Neetu Meena. Organic Farming: a Beneficial step for farmers *Rastriye Krishi*, Volum -16, Issue -2, August, 2021, ISSN09731512.
  - B.R. Choudhary. 2022. Low tunnel technology: best alternate of high profit in hot arid region (in Hindi). *Haldhar Times*, No. 4 (12-18 Dec., 2022), Page No. 5.
  - B.R.Choudhary. 2022. Cultivation of cucurbitaceous vegetables under low tunnels. (In Hindi). *Haldhar Times*, No. 5 (19-25 Dec., 2022), Page No. 5.
  - D. K. Samadia, A. K. Verma, Hanuman Ram and P. S. Gurjar. Palak variety Thar Hariparna for abiotic stressed hot arid climate. *Indian Horticulture*: Sept-Oct 2022, 48-50
  - D. K. Samadia, A. K. Verma, P. S. Gurjar and Hanuman Ram. Thar Tapish: Sponge gourd variety developed for hot arid climate. *Indian Horticulture*: July-August 2022, 6-8
  - D.K. Sarolia, L. Kumar, K.L. Kumawat, M.K. Choudhary, J.S. Gora and R. Kumar. Cultivation of ber. In: *Phal-Phul, Farmer farm, innovations, resource science & technology*, New Delh, 2022, pp.37-41.
  - D.S.Mishra, S. Singh, V. Yadav, and B.D. Sharma. 2022. Thar Vaibhav: A new bunch bearing variety of acid lime. *Indian Horticulture*, 67(4):3-5.
  - H. Krishna, A.K. Singh and R.K. Meena. *Versha ki phuhar laye bagoan me bahar*. *Phal Phul*: 2022, 43(3):47-51.
  - H. Krishna, A.K. Singh, R.K. Meena and P.P. Singh. *November-december mein bagwani ke karyakalap*. *Phal Phul*: 2022, 43(6):45-48.
  - H. Krishna, A.K. Singh, R.K. Meena and P.P. Singh. *Sharad Ritu mein bagwani karyakalap*. *Phal Phul*: 2022, 43(4):52-55.
  - H. Krishna, A.K. Singh, S.K. Maheshwari and N.V. Singh. *Basant mein kare bagoan ki vishesh dekhbhal*. *Phal Phul*: 2022, 43(2):69-74.
  - H. Krishna, A.K. Singh, S.K. Maheshwari and N.V. Singh. *January-February ke bagoan ke karya*. *Phal Phul*: 2022, 43(1):61-66.
  - H. Krishna, A.K. Singh, S.K. Maheshwari and R.K. Meena. *May-June mein kiye jane wale bagwani Karya*. *Phal Phul*: 2022, 43(3):57-64.
  - K.L. Kumawat, A. Sharma, W.H. Raja, O.C. Sharma and J.I. Mir. Untimely snowfalls An emerging concern for temperate fruit growers in Kashmir valley. *Indian Horticulture*: 2022, 67(1): 21-26.
  - K.L. Kumawat, W.H. Raja and S.U. Nabi. Pruning in apple trees -Important considerations. *Indian Horticulture*: 2022, 67(5): 31-36.
  - Neerupama Singh, Aarti Kumari, S.P. Singh and Anita Meena. Nutri-cereal pearl millet: Importance and challenges ahead., *Rastriya Krishi*, Volum -15, Issue -2, Deember, 2020, ISSN09740759, 67-69.
  - R. Selvakumar, P.K. Singh, K.Gangadhara, D.C. Manjunathagowda, K. Jugendra. 2022. Vegetable Microgreens: A super food for the future. *Krishisewa* (February) <https://www.krishisewa.com/crop-cultivation/1387>.
  - S. Khajuria, A.K. Rai and R. Kumar. 2022. On Farm Trial: An approach for management of pink bollworm, *Pectinophora gossypiella* Saunders in Bt cotton *AgriGate Magazine - An International Multidisciplinary E-Magazine* 2(2): 47-50.
- g) **Compendium & proceedings chapter**
- A.K. Singh. Prospects of genetic resources and varietal wealth of semi-arid fruit crops for

- prosperity and health security. In: Souvenir, Singh et.al. (eds) (2020). Published by organizing Secretary and President SHRD, U. P. India. Pp. 20-27.
- B.R Choudhary, A.K. Verma, and Dhurendra Singh. Off season vegetable cultivation under low tunnels: A boon to arid zone farmers. In: Compendium of lectures: ICAR sponsored Winter School on 'Advances in Irrigation Technologies and Nutrient Management in Arid Horticulture Crops' held at SKRAU, Bikaner during 08-28 March, 2022. Pp. 280-294.
  - B.R. Choudhary and Dhurendra Singh. Potential of traditional vegetables crops of hot arid region. In: Compendium for Winter School on "Underexploited Vegetables: Unexplored Treasure Trove for Food, Nutritional and Economic Security" held at ICAR-IIVR, Varanasi during 02-22 February, 2022. (Eds. Dubey, R.K., Prasad, I, Gupta N. and Behera, T.K) (2022). Pp. 105-114.
  - Birbal, K.R. Sheetal, P.S. Renjith, J. S. Gora and Mahendra Choudhary. Role of agro-techniques in enhancing water use efficiency of horticultural crops in arid and semi-arid environment (2022). Advances in irrigation technology and nutrient management in arid horticultural crops. pp. 106-121.
  - D. K. Samadia, A. K. Verma, Hanuman Ram and P. S. Gurjar. Innovative and low-cost technologies for improving productivity of vegetable crops under hot arid conditions. Advances in Irrigation Technology and Nutrient Management in Arid Horticulture Crops. Yadav, P. K., Kharia, S. K., Narolia, R. K., Rathore, R. S. and Tyagi, S. (eds.) (2022), Swami Keshwanand Rajasthan Agricultural University, Bikaner, Rajasthan, India. pp. 330-343.
  - D. K. Sarolia, K. L. Kumawat, M. K. Chaudhary and L. Kumar. Advances in production system management of ber (*Zizyphus maritiana* Lamk.). In: Advances in irrigation technology and nutrient management in arid horticulture crops. Yadav, P.K., Kharia, S.K., Narolia, R.K., Rathore, R.S. & Tyagi, S. (eds.) (2022), Swami Keshwanand Rajasthan Agricultural University, Bikaner, Rajasthan, India, pp-376-387.
  - D. Singh, D.K. Sarolia, R.K. Meena and Kamlesh Kumar. High tech propagation of horticultural crops a water saving option in arid region. In: advances in irrigation technology and nutrient management in arid horticulture crops. Yadav, P.K., Kharia, S.K., Narolia, R.K., Rathore, R.S. and Tyagi Seema (eds.) (2022). Published by SKRAU, Bikaner: pp 74-91.
  - K. Kumar, D.K. Samadia, D.K. Sarolia, P.S. Gurjar, and D. Singh. Exploitation of genetic diversity of ber (*Capparis deciduas* Edgew (Forssk.)) through standardization of multiplication technique and plant standards. In: National Seminar on Fruit production in Eastern Tropical Region of India: Challenges and Opportunities. Kishore K., Acharya G.C., Sahoo M.R., Samant D. and Srinivas P. (eds.) (2022). Published by ICAR-Indian Institute of Horticultural Research, Bengaluru' RRS, Bhubaneswar, pp. 118.
  - R. Kumar, J. S. Gora, M. K. Berwal and K. L. Kumawat. Advances in production technology of pomegranate with special emphasis on irrigation and nutrient management. In: Advances in irrigation technology and nutrient management in arid horticulture crops. Yadav, P.K., Kharia, S.K., Narolia, R.K., Rathore, R.S. & Tyagi, S. (eds.) (2022), Swami Keshwanand Rajasthan Agricultural University, Bikaner, Rajasthan, India, pp-404-414.
  - R. Kumar, K.M. Sharma, C.M. Murlidharan, D.K. Samadia and V. Pandey. Proceedings of consultation meet on date palm cultivation (2022). PC Cell, AICRP-AZF, ICAR-CIAH, Bikaner. p 1-28.
  - R.K. Meena, D.K. Sarolia, K.L. Kumawat & P.S. Gurjar. Nursery management & mass multiplication of arid fruit crops for entrepreneurship and income generation. In: Advances in irrigation technology and nutrient management in arid horticulture crops. Yadav, P.K., Kharia, S.K., Narolia, R.K., Rathore, R.S. & Tyagi, S. (eds.) (2022), Swami Keshwanand Rajasthan Agricultural University, Bikaner, Rajasthan, India, pp-606-620.
  - Yadav L. P. 2022. Microgreens: New generation Nutri-rich smart Food for Nutritional security. Dubey R K, Prasad I, Gupta N and Behera, T. K. (2022). Underexploited Vegetables: Unexplored treasure trove for Food, Nutritional and Economic Security. Training Manual No.99. Published by ICAR-Indian Institute of Vegetable Research, Varanasi-221305, Uttar Pradesh. pp 493.
- h) Abstracts in Seminar/Symposium/Conference



- etc.
- A. K. Singh. 2022. Bael varieties for dryland. In: 2<sup>nd</sup> Indian Horticulture Summit-2022, at the Navsari Agricultural University, Navsari, Gujarat.
  - A. K. Verma, D. K. Samadia, C. Ram, H. Ram and K. Gangadhara. 2022. Characterization and identification of photo-thermo insensitive genotypes of cowpea for climate resilience under hot arid environment. In International Conference on Advances in Agriculture & Food System Towards Sustainable Development Goals August 22 - 24 , 2022, pp. 389. ISBN : 978-93-93878-79-3
  - Anita Meena, R.C. Balai, M.K. Jatav and B. D. Sharma 2022: “Production of Snapmelon (*Cucumis melo var. Momordica*) under saline water irrigation in hot arid region in International Conference on ICAAAS-2022 at HPU, Shimla on date 12-14 June 2022.
  - Anita Meena, R.C. Balai, M.K. Jatav and B. D. Sharma 2022: Use of saline water with amendments for higher production of Snapmelon (*Cucumis melo var. momordica*) under hot arid region in International Conference on global research Initiatives for Sustainable Agriculture and Allied Science (GRISAAS-2021), scheduled to be held during 13-15 December, 2021 on virtual mod.
  - AppaRao, V.V., Sanjay Singh, Singh, A.K., Mishra, D.S., Saroj, P.L. and Sharma, B.D. 2022. DRIS norms in jamun. In Book of abstracts. 2<sup>nd</sup> Horticultural Summit-2022-27-29 April 2022 at Navasari agricultural University, Navasari, Gujarat, India-Page No-35.
  - AppaRao, V.V., Sanjay Singh, Singh, A.K., Mishra, D.S., Saroj, P.L. and Sharma, B.D. 2022. DRIS norms in chironji. In Book of abstracts. 2<sup>nd</sup> Horticultural Summit-2022-27-29 April 2022 at Navasari agricultural University, Navasari, Gujarat, India-Page No-68.
  - D. K. Sarolia, P. L. Saroj, B. D. Sharma, S. M. Haldhar, S. K. Maheshwari, M. K. Choudhary and L. Kumar. 2022. Response of ber varieties at different training systems under hot arid ecosystem. In: 31<sup>st</sup> national conference on “Innovator resource management approaches for coastal and inland ecosystems to sustain productivity and climate resilient (13-15 October) at NAU, Navsari, Gujarat. pp. 142-143.
  - Gangadhara K, Lalu Prasad Yadav, V.V. Apparao A. K. Singh and B.D.Sharma. 2022. Purple Indian bean: A nutraceutical rich bean for health security” In “2<sup>nd</sup> Indian Horticulture Summit 2022 at NAU, Navsari (Gujarat), during 27-29 April 2022.
  - Gangadhara K, Lalu Prasad Yadav, V.V. Apparao A. K. Singh and B.D.Sharma. 2022. “Genetic divergence studies in Indian bean (*Lablab Purpureus var. typicus*) under rainfed semi-arid conditions” In “2<sup>nd</sup> Indian Horticulture Summit 2022 at NAU, Navsari (Gujarat), during 27-29 April 2022.
  - Gangadhara K, Lalu Prasad Yadav, V.V. Apparao A. K. Singh and B.D.Sharma. 2022. Genetic variability in pole type dolichosbean under rainfed semi arid conditions. In national symposium on 'Self-Reliant Coastal Agriculture' organised by Association for coastal agricultural research (ACAR) held at ICAR-Central Coastal Agricultural Research Institute, Goa during 11-13 May 2022.
  - Hanuman Ram, D. K. Samadia, A. K. Verma, P. S. Gurjar and M. K. Choudhary. 2022. Evaluation of Chilli (*Capsicum Annum L.*) Germplasm under Heat Stressed Ecosystem of Rajasthan. In “IV<sup>th</sup> International Conference in Hybrid Mode on Innovative and Current Advances in Agriculture & Allied Sciences-ICAAAS-2022” (An International Event) June 12-14, 2022, pp. 539-540.
  - Hanuman Ram, D. K. Samadia, C. Ram, and A. K. Verma. 2022. Phenotypic and molecular characterization of chilli genotypes under hot arid region of India. In National Conference cum 9<sup>th</sup> Rajasthan Science Congress Dec 15 -17, 2022, pp. 93-94
  - Hanuman Ram, D. K. Samadia, P. S. Gurjar and A. K. Verma. 2022. Standardization of horticultural maturity indices through growth and development study in bottle gourd. In “Book of Abstracts: 2<sup>nd</sup> Indian Horticulture Summit-2022” (A National Event) April 27-29, 2022, pp. 30
  - Hanuman Ram, S. Dhar, H. Choudhary, R. K. Sharma, L. Prasad, A. U. Solanke and B. S. Tomar. 2022. Estimates of genetic components of variation for earliness and yield traits in garden pea (*Pisum sativum L.*). In “Book of Abstracts: 2<sup>nd</sup> Indian Horticulture Summit-2022” (A National Event) April 27-29, 2022, pp. 141.
  - J.S. Gora, R. Kumar, P. Kumar and R.C. Balai. 2022. Performance Evaluation of Citrue Scion and Rootstock Cultivars under Hot Arid Environment of Rajasthan In “National Conference cum 9<sup>th</sup> Rajasthan Science

- Congress on Harnessing Fronteir Science and Technologies for Food, Nutrition, Health and Environment Security-2022” December 15- 17, 2022, pp. 24.
- K. Kumar, D. K. Samadia, D. K. Sarolia, P. S. Gurjar and D. Singh. 2022. Exploitation of genetic diversity of ker {*Capparis deciduas* Edgew (Forssk.)} through standardization of multiplication technique and plant standards. In: National Seminar on Fruit production in Eastern Tropical Region of India: Challenges and Opportunities. Kishore K., Acharya G.C., Sahoo M.R., Samant D. and Srinivas P. (eds.). Published by ICAR-Indian Institute of Horticultural Research, Bengaluru' RRS, Bhubaneswar, pp. 118.
  - Lalu Prasad Yadav, Gangadhara K, V.V. Apparao A. K. Singh and B.D.Sharma. 2022. Thar Sadabahar: A new variety of coccinia for round the year cultivation. In “2<sup>nd</sup> Indian Horticulture Summit 2022 at NAU, Navsari (Gujarat), during 27-29 April 2022.
  - Lalu Prasad Yadav, Gangadhara K, V.V. Apparao A. K. Singh and B.D.Sharma. 2022. Antioxidants and nutritional properties of drumstick (*Moringa oleifera* L.) germplasm under arid and semi-arid regions. In “2<sup>nd</sup> Indian Horticulture Summit -2022 at NAU, Navsari (Gujarat), during 27-29 April 2022.
  - Lalu Prasad Yadav, Gangadhara K, V.V. Apparao A. K. Singh and D K Samadia. 2022. Thar Avani: A new round shape bottle gourd. In “National Conference Cum 9<sup>th</sup> Rajasthan Science Congress on Harnessing Frontier Sciences and Technologies for Food, Nutrition, Health and Environmental Security” December 15-17, 2022.
  - M. K. Berwal, C. Ram, R. Kumar and J. S. Gora. 2022. The New Insights of Abiotic Stresses in Horticulture: Hot Arid Region of Western Rajasthan as Potential Avenue for Molecular Farming. In Proc. National conference: Emerging Innovations in Plant Molecules for Achieving Food and Nutritional Security held at NAU, Navsari during September 22-23, 2022.
  - M. K. Choudhary, H. Ram, K. L. Kumawat, P. S. Gurjar, K. Kumar, L. Kumar, D. K. Sarolia and D. Singh. 2022. Pre-breeding for biotic and abiotic stresses in horticultural crops for developing climate resilient material. In “Book of Abstracts: 2<sup>nd</sup> Indian Horticulture Summit-2022” (A National Event) April 27-29, 2022, pp. 130
  - P. S. Gurjar, A. K. Verma, H. Ram, M. K. Choudhary and D. K. Samadia. 2022. Pre-harvest Fruit Growth Pattern, Maturity Indices, Standardization and Dehydration of Sponge gourd Grown under Hot Arid Region. In National Conference cum 9<sup>th</sup> Rajasthan Science Congress Dec 15 - 17, 2022, pp. 95-96
  - P. S. Gurjar, M. K. Berwal and D. K. Samadia. 2022. Technology developed for *sangri* processing and packaging to promote horticultural entrepreneurship in rural areas. In National conference cum 9<sup>th</sup> Rajasthan Science Congress on Harnessing Frontier Sciences and Technologies for Food, Nutrition, Health and Environmental Security, December 15 -17, 2022, SKNAU, Jobner, Jaipur, pp. 103.
  - R. K. Meena, C. Ram, M. K. Choudhary, K. L. Kumawat and D. K. Sarolia. 2022. Genetic diversity on male date palms (*Phoenix dactylifera* L.) in hot arid ecosystem of western Rajasthan. In 31<sup>st</sup> National conference on innovative resource management approaches for coastal and inland ecosystem to sustain productivity and climate resilience” held at SCSi in collaboration with NAU, Navasari, Gujarat during 13-15 October 2022.
  - R. K. Meena, M. K. Choudhary, C. Ram and K. L. Kumawat. 2022. Evaluation of male date palm for higher yield and quality traits under hot arid ecosystem. In VIIth international conference on “Global Research Initiative for sustainable Agriculture and Allied Science held Birsa Agriculture University, Ranchi, Jharkhand, India during 21-23 November 2022, pp 101.
  - Ramya D.G.S, S.K. Maheshwari, A.K. Verma, Anita Meena, R. Kumar, R.K. Meena & M.K. Jatav 2022: Eco-friendly indigenous botanicals for effective control of *Alternaria* sp. in arid region of Rajasthan. presented in “IPS Central Zone Symposium-2022 and National Conference on Phytopathology on Sustainable Disease Management and Food Security” being organized by Indian Phytopathological society, New Delhi from 31st October to 2<sup>nd</sup> November 2022 at ANGRAU, RARS, Tirupati-643231.
  - S. K. Maheshwari, B. R. Choudhary, S. M. Haldhar and B. D. Sharma. 2022. Screening of muskmelon germplasm for resistance against Fusarium wilt under field conditions of western Rajasthan. Abstract published in National Symposium (online) on “Recent Trends in Phytopathology to Address Emerging Challenges for Achieving Food Security” organized by ICAR-VPKAS, Almora and

Indian Phytopathological Society (Mid-Eastern Zone Chapter) during 21-22 Feb., 2022, p. 46-47.

- S. K. Maheshwari, D. G. S. Ramyashree, R. Kumar and B. D. Sharma. 2022. Occurrence of Emerging Major Diseases in Pomegranate under Hot Arid Conditions in Rajasthan. Presented oral presentation in 2<sup>nd</sup> Indian Horticultural Summit 2022 on Horticulture for Prosperity and Health Security during 27-29<sup>th</sup> April, 2022 at Navsari Agricultural University, Navsari, Gujarat, India, Abs., pp. 183-184.

i) **Success stories published**

- Khajuria, S. Rai, A. K. and Kumar, R., 2022. Success story of IPM technology adopted by farmer in Bt cotton. AgriGate Magazine - An International Multidisciplinary E-Magazine. 2(12):51-53.
- Khajuria, S. Rai, A. K. and Kumar, R., 2022.

Success story on management of little gourd fruit fly, *Bactrocera cucurbitae*-The IPM way AgriGate Magazine An International Multidisciplinary E-Magazine. 2(4): 73-75.

- Kumar, R., Rai, A.K. and Khajuria, S. 2022. Arka Rakshak Tomato for more income - A success story AgriGate Magazine An International Multidisciplinary E-Magazine June 2(SI2)46-49.
- Kumar, R., Rai, A.K. and Khajuria, S. 2022. High density planting of cauliflower-A success story AgriGate Magazine An International Multidisciplinary E-Magazine Feb 2(2)39-52.
- Kumar, R., Rai, A.K. and Khajuria, S. 2022. Summer okra cultivation a good venture for farmers-Success story AgriGate Magazine An International Multidisciplinary E-Magazine Feb 2(2)98-101.

## 10. RESEARCH PROJECTS

On-going Research Projects		Name of PI & Co-PI
<b>CIAH:1</b>	<b>Introduction, collection, characterization, conservation and evaluation of germplasm of arid and semi-arid fruit and vegetable crops</b>	
(a)	Ber ( <i>Ziziphus</i> spp.)	Dr. D. K. Sarolia Sh. M. K. Choudhary
(b)	Pomegranate ( <i>Punica granatum</i> L.)	Dr. Ramesh Kumar Dr. D. S. Mishra Dr. Chet Ram Dr. Pawan Kumar
(c)	Date palm ( <i>Phoenix dactylifera</i> L.)	Dr. Ramkesh Meena Dr. P.S. Gurjar Sh. M. K. Choudhary
(d)	Aonla ( <i>Emblica officinalis</i> Gaertn)	Dr. A. K. Singh Dr. D. S. Mishra Sh. M. K. Choudhary
(e)	Bael ( <i>Aegle marmelos</i> Correa.)	Dr. A. K. Singh Dr. Ramkesh Meena Dr. K. L. Kumawat
(f)	Wood apple ( <i>Feronia limonia</i> ) and custard apple ( <i>Annona squamosa</i> )	Dr. A. K. Singh
(g)	Jamun, tamarind, Rayan, Chironji, Mahua, Karonda, Tendu, Indian dates, Palmyra palm.	Dr. D. S. Mishra Dr. V. V. Appa Rao Dr. P.S. Gurjar
(i)	Guava and acid lime.	Dr. D. S. Mishra Dr. V. V. Appa Rao Sh Jagan Singh Gora
(j)	Underexploited fruits (lasoda, ker, karonda & mulberry)	Dr. Kamlesh Kumar Dr. Chet Ram
(k)	Maintenance and use of arid vegetable genetic resources for crop improvement.	Dr. D. K. Samadia Dr. Ajay Kumar Verma Dr. Hanuman Ram
(l)	Cucurbitaceous crops (Muskmelon, watermelon, sponge gourd and long melon)	Dr. B. R. Choudhary Dr. S. K. Maheshwari Dr. Hanuman Ram
(m)	Introduction, collection, characterization, conservation and evaluation of vegetable crops (dolichos bean, cluster bean and cowpea) under rainfed semi-arid conditions of western India.	Dr. Gangadhara, K. Dr. V. V. Appa Rao Dr. L. P. Yadav
(n)	Introduction, collection, characterization, conservation and evaluation of germplasm of drumstick, spine gourd, ivy gourd, tomato, pumpkin and bottle gourd.	Dr. L. P. Yadav Dr. V. V. Appa Rao Dr. Gangadhara, K.
(o)	Collection, conservation and utilization of un-tapped minor fruits of hot arid region ( <i>New Project</i> )	Dr. K. L. Kumawat Dr. P. S. Gurjar
<b>CIAH:2</b>	<b>Improvement of arid and semi arid fruit and vegetable crops including biotechnological interventions</b>	
(a)	Enhancement of genetic potency of tomato and chilli under heat stressed arid environment.	Dr. Hanuman Ram Dr. Ajay Kumar Verma Dr. D. K. Samadia

(b)	Biochemical mechanism of abiotic stress tolerance in arid horticultural crops.	Dr. Mukesh K. Berwal Dr. Chet Ram
(c)	Development, exploitation and validation of genomic resources for enhanced utilization of arid horticultural crops.	Dr. Chet Ram Dr. M. K. Berwal Dr. Ajay K. Verma Dr. Kamlesh Kumar Dr. Ramesh Kumar
(d)	Genetic improvement of arid vegetable legumes for quality yield under heat stressed environment. ( <i>New Project</i> )	Dr. A. K. Verma Dr. Hanuman Ram Dr. R. P. Meena
(e)	Breeding behavior and population studies in fruits and native perennial crop-plants under hyper arid environment. ( <i>New Project</i> )	Dr. Pawan Kumar Sh. M. K. Choudhary
(f)	Population studies for genetic improvement in selected perennial crop-plants under hyper arid condition ( <i>New Project</i> )	Sh. M. K. Choudhary Dr. Pawan Kumar
<b>CIAH:3</b>	<b>Standardization of arid and semi-arid fruits and vegetables production technology</b>	
(a)	Intensification of research on tissue cultured date palm in hot arid region.	Dr. Ramkesh Meena
(b)	Standardization of production technology of <i>bael</i> under rainfed semi-arid conditions of western India.	Dr. A. K. Singh Dr. V. V. Appa Rao
(c)	Studies on compatibility and adaptability of citrus rootstock under hot arid environment of Rajasthan.	Sh Jagan Singh Gora Dr. Ramesh Kumar Sh. Roop Chand Balai Dr. Pawan Kumar
(d)	Studies on flowering regulation, cracking management and rootstock adaptability in pomegranate under hot arid environment of Rajasthan.	Dr. Ramesh Kumar Dr. M. K. Jatav Dr. Ramkesh Meena Sh Jagan Singh Gora
(e)	Nutrient management in chironji, custard apple, jamun and tamarind.	Dr. V. V. Appa Rao Dr. A. K. Singh Dr. D. S. Mishra
(f)	Production system management in <i>ber</i> under hot arid ecosystem.	Dr. D. K. Sarolia Dr. S.K. Maheshwari
(g)	Standardization of production technology of jamun and custard apple under semi-arid conditions of western India.	Dr. D. S. Mishra Dr. V. V. Appa Rao
(h)	Response of date palm cultivar to pollen sources, pollen quality, quantity and suitability under hot arid ecosystem.	Dr. Ramkesh Meena Dr. Chet Ram Shri M. K. Choudhary
(i)	Protected cultivation of vegetables under hot arid conditions.	Dr. Ajay Kr. Verma Dr. Dharendra Singh Dr. D. K. Samadia Dr. B. R. Choudhary
(j)	Management practices for saline soil and water for crop production in arid region.	Dr. Anita Meena Shri R. C. Balai
(k)	Development of native crop-plant production system using saline water under hot arid environment.	Shri R.C. Balai Dr. Anita Meena
(l)	Organic farming in arid horticultural crops ( <i>New Project</i> )	Dr. M.K. Jatav
(m)	Water management studies in arid fruits crops ( <i>New Project</i> )	Dr. M.K. Jatav

<b>CIAH:4</b>	<b>Plant health management studies in arid and semi-arid fruit and vegetable crops</b>	
(a)	Development of a bio-fertilizer cum bio-pesticide formulations of native <i>Rhizobium</i> sp. for vegetable cultivation.	Dr. R.P. Meena Dr. Anita Meena
(b)	Major diseases and their control measures in important arid fruit crops (pomegranate and date palm).	Dr. S. K. Maheshwari Dr. Ramkesh Meena Dr. Ramesh Kumar
(c)	Detection and diagnosis of virus and virus like pathogens associated with horticulture crops grown in hot arid regions. ( <i>New Project</i> )	Dr. R. P. Meena Dr. Chet Ram
<b>CIAH:5</b>	<b>Post harvest management studies</b>	
(a)	Development of functional foods and nutraceutical value added products from arid horticultural crops.	Dr. Mukesh K. Berwal Dr. Ramesh Kumar Dr. P.S. Gurjar
(b)	Standardization of techniques for pre and post-harvest management, value addition and commercialization of desert horticultural crop-plants. ( <i>New Project</i> )	Dr. P. S. Gurjar Dr. Mukesh K. Berwal Dr. K. L. Kumawat
<b>CIAH:6</b>	<b>Agriculture extension studies</b>	
(a)	Impact assessment of adoption of pomegranate and date palm in hot arid and semi-arid regions of Rajasthan.	Dr. S. R. Meena Shri R. C. Balai

#### Externally funded projects/Collaborative projects

Sr. no.	Project Name	Name of PI & Co-PI
1.	DUS centre for watermelon and muskmelon.	Dr. B. R. Choudhary Dr. Hanuman Ram
2.	DUS centre for ber	Dr. D. K. Sarolia
3.	DUS centre for date palm.	Dr. Ramkesh Meena
4.	DUS nodal centre for bael.	Dr. A. K. Singh
5.	DUS co-nodal centre for aonla.	Dr. A. K. Singh
6.	DUS co-nodal centre for jamun.	Dr. D.S. Mishra
7.	DUS nodal centre for chironji and tamarind.	Dr. A.K. Singh
8.	Enhancing food and water security in arid region through improved understanding of quantity, quality and management of blue, green and grey water.	Dr. Ramesh Kumar
9	Development of Hi -tech horticultural nursery with water harvesting structure (RKVY)	Dr. A.K. Singh Dr. L.P. Yadav Dr. V.V. Appa Rao
10	Production of quality planting material of khejri (FSPF - NABARD)	Dr. D.K.Sarolia Dr. R.K. Meena Dr. K.L. Kumawat Dr. P.S. Gurjar

#### Externally funded project

**Title-Development of Hi-Tech Horticultural Nursery with water harvesting structure (4 Ha area under nursery with water harvesting structure)**

Dr. A. K. Singh (PI), Dr. Lalu Prasad Yadav (CoPI),  
Dr. Vikas Yadav (CoPI), Dr. V.V. Apparao (CoPI)

Funding agency- Rashtriya Krishi Vikas Yojana (RKVY), Govt. of India

Cost- 170.73 lakhs

Duration- 2021-2024 (there years)

## 11. RAC, IMC AND IRC

### Research Advisory Committee

In pursuance of Rule 71(A) of the Rules and Bye-laws of the ICAR Society, the Director General, ICAR, New Delhi has constituted the following Research Advisory Committee to review the progress of the ongoing research programme and suggest the future modalities of the future programme. The RAC meeting was not held during 2022.

#### Chairman

Dr. V. S. Thakur,  
Former-Vice Chancellor  
YSPUHF, Solan

#### Members

Dr. D. P. Waskar  
Director of Research  
Vasantrao Naik Marathwada Krishi Vidyapeeth  
Parbhani-431 402 (MS)

Dr. Premananda Mahapatra  
Former Head, Div. of Hort, OUAT  
and Dean, SOA University Bhubaneswar

Dr. A. B. Rai  
Former-Head,  
ICAR-IIVR, Varanasi

Dr. B. N. S. Murthy,  
Former Director  
ICAR-IIHR, Bengaluru

Dr. Govind Singh,  
Former Director of Research  
SKRAU, Bikaner

#### Asstt. Director General (Hort. Sci.)

ICAR, KAB-II  
New Delhi

Sh. Sharan Pal Singh (Farmer nominee)  
Suratgarh

#### Director

ICAR-CIAH, Bikaner

#### Member Secretary

Dr. S. K. Maheshwari

Principal Scientist  
ICAR-CIAH, Bikaner

### Institute Research Council

During the reported period, the meeting was held at ICAR-CIAH, Bikaner on 5-6, Aug., 2022 to discuss the progress of the ongoing research programmes and to finalize the new proposals. and meeting was chaired by Director of the Institute. The progress of ongoing research projects were presented in details by the scientist and discussion were also held on new project proposal.

#### Chairman

Dr. D. K. Samadia, Director (Acting), ICAR-CIAH, Bikaner

#### Member

All Scientists of the Institute

#### Member Secretary

Dr. R. P. Meena, Sr Scientist

### Institute Management Committee

#### Chairman

Director  
ICAR-CIAH, Bikaner

#### Members

Vice Chancellor  
SKRAU, Bikaner

Director of Horticulture,  
Govt. of Rajasthan

Asstt. Director General (Hort. Sci.),  
ICAR, New Delhi

Sh. Sharan Pal Singh  
Suratgarh

#### Member Secretary

Administrative Officer  
ICAR-CIAH, Bikaner

IMC meeting was not held during 2022

## 12. LINKAGE AND COLLABORATION

Rajmata Vijaraje Scindia Krishi Vishwa Vidyalaya,  
Gwalior, MP  
SK Rajasthan Agricultural University, Bikaner  
Sri Karan Narendra Agriculture University, Jobner  
(Jaipur)  
RNB Global University, Bikaner

Dr. Y.S.R. Horticultural University, West  
Godawari, Andhra Pradesh  
ICAR-NRC on Camel: Horti-pasture development  
and livestock camel production (camel foraging on  
feed technology based on the concept 'Best from  
Waste').

### MoA with entrepreneurs

Sl No.	Name of Technology	Name of Scientists developed the technologies	Licensed to	Licensed exclusive or non-exclusive	Year of Licensing	Amount charge for Licensing
1.	Authorize multiplication Bael variety- Goma Yashi	Dr A K Singh	Ambica Agro Anand	Non-exclusive license	07.01.2022	175000/-
2.	Establishment of orchards of different fruit crops and value chain	Dr. D K Sarolia Dr. Ramesh Kumar Dr. P S Gurjar Mr. J S Gora Dr. Dhurendra Singh	Sh. L N Somani M/s Somani Agro Farm, Shridungargarh, Bikaner	Consultancy	31.03.2022	15000/
3.	Establishment of orchards of different fruit crops and value chain	Dr. Ramesh Kumar Dr. P S Gurjar Mr. J S Gora	Mindroot Foundation Jaipur  Project site : Taranagar District Churu	Consultancy	24.06.2022	14000/
4.	Establishment of orchards of native perennial crops and value chain	Dr. Ramesh Kumar Dr. P S Gurjar Mr. J S Gora	Mindroot Foundation Jaipur  Project site : Taranagar District Churu	Consultancy	24.06.2022	14000/
5.	TFL seed production of kachri Var. AHK 119	Dr. A.K. Verma Dr. D. K. Samadia	Sh Mayank Purohit, Khara The. Bikaner, District Bikaner	Non exclusive license	27.06.2022	15000
6.	TFL seed production of Snap melon Var. AHS 82	Dr. A.K. Verma Dr. D. K. Samadia	Sh Ghanshayam, Ratanpura Tehsil Nohar District Hanumangarh	Non exclusive license	29.12.2022	15000



### 13. RAJBHASHA

#### राजभाषा कार्यन्वयन समिति की बैठक एवं त्रैमासिक हिन्दी कार्यशाला

कलैण्डर वर्ष 2022 के दौरान राजभाषा कार्यन्वयन समिति की तिमाही बैठकों का आयोजन क्रमशः दिनांक 15 मार्च, 2022, 15 जून, 2022, 05 सितम्बर, 2022 एवं 19 दिसम्बर, 2022 को किया गया था। इन सभी बैठकों में संस्थान की राजभाषा गतिविधियों की समीक्षा की गयी एवं हिन्दी की प्रगति को संस्थान के दैनिक कार्यों में सुनिश्चित किया गया। इन बैठकों का कार्यवत्त तैयार कर उसी अनुसार कार्रवाई की गयी।

संस्थान में कार्यरत अधिकारियों/कर्मचारियों को हिन्दी में कार्य करने की प्रेरणा के लिए राजभाषा विभाग के निर्देशानुसार चार त्रैमासिक कार्यशालाओं का आयोजन किया गया। वर्ष 2022 की पहली कार्यशाला का आयोजन दिनांक 26 मार्च, 2022 को किया गया जिसमें "राजभाषा हिन्दी में जाने दंत चिकित्सा एवं दांतों की आवश्यक देख-रेख" विषय पर व्याख्यान का आयोजन किया गया। इसमें दंत चिकित्सक डॉ. ध्रुपद माथुर ने व्याख्यान दिया। उन्होंने दांतों की देखभाल की विधियों और उनमें लगने वाली बीमारियों तथा उनके उपायों के बारे में हिन्दी राजभाषा में विस्तार से चर्चा की जिसे सभी अधिकारियों एवं कर्मचारियों ने सराहा। वर्ष की दूसरी कार्यशाला दिनांक 24 जून, 2022 को आयोजित की गयी जिसमें "मानसिक

स्वास्थ्य" विषय पर डॉ. डी. एस. पूनिया, एमडी, एम्स दिल्ली ने व्याख्यान दिया। इसी क्रम में तीसरी कार्यशाला का आयोजन संयुक्त रूप से क्षेत्रीय केन्द्र वेजलपुर पर 12-13 सितम्बर, 2022 को किया गया जिसमें श्री मनोज कुमार, मुख्य तकनीकी अधिकारी, भाकृअनुप, नई दिल्ली ने इसमें भाग लेकर अपना व्याख्यान दिया था। वर्ष 2022 की अंतिम कार्यशाला का आयोजन दिनांक 30 दिसम्बर, 2022 को किया गया जिसमें "स्वच्छता पखवाड़ा और उसकी उपयोगिता" विषय पर व्याख्यान दिया गया।



हिन्दी कार्यशाला के दौरान व्याख्यान देते अतिथि डॉ. ध्रुपद माथुर



क्षेत्रीय केन्द्र, वेजलपुर की हिन्दी गतिविधियों का निरीक्षण करते हुए अधिकारी एवं संयुक्त हिन्दी कार्यशाला के दौरान व्याख्यान देते श्री मनोज कुमार

## हिंदी पखवाड़ा का आयोजन

संस्थान में दिनांक 16 से 30 सितम्बर 2022 तक हिंदी पखवाड़ा आयोजित किया गया। एक पंद्रह दिनों तक चले इस आयोजन में विभिन्न प्रतियोगिताएं रखी गयी थी, जिनमें संस्थान के वैज्ञानिकों के सहित सभी कार्मिकों ने भाग लिया। इस दौरान 14 सितम्बर 2022 को हिन्दी दिवस का आयोजन किया गया था।

हिन्दी पखवाड़े का समापन दिनांक 30 सितम्बर को किया गया। दिनांक 16 से 30 सितम्बर 2022 तक चल इस पखवाड़े के दौरान संस्थान में हिन्दी के प्रयोग को बढ़ावा देने के लिए अनेक कार्यक्रमों का आयोजन किया गया।

समापन कार्यक्रम के मुख्य अतिथि डॉ. रजनीरमण झा, सह प्राध्यापक महारानी सुदर्शना राजकीय बालिका महाविद्यालय, बीकानेर ने कहा कि हिंदी भारत की आत्मा है। यह मजदूरों, किसानों और जन साधारण के द्वारा बढ़ायी गयी भाषा है। भारत में भाषा का विकास राज्याश्रय से हुआ परन्तु हिन्दी को कभी राज्याश्रय नहीं मिला। हिन्दी किसी

राज्य की भाषा नहीं थी। हिन्दी बहुत ही उदार भाषा है। हिन्दी के बिना काम नहीं चलेगा। इसे अपनाया संविधान प्रदत्त है। हिंदी के साथ अन्य भारतीय भाषाओं को भी सीखने की बात पर उन्होंने जोर दिया।

इस अवसर पर अध्यक्षता करते हुए संस्थान निदेशक डॉ. डी. के. समादिया ने कहा कि भारत सरकार की योजना के अंतर्गत संस्थान में हिन्दी भाषा पर बहुत कार्य किया जाता रहा है। सभी लोग हिन्दी बोलते हैं और किसानों को सभी प्रकार के प्रशिक्षण हिंदी में ही दिए जाते हैं।

इससे पूर्व हिन्दी पखवाड़ा आयोजन समिति के अध्यक्ष डॉ. दीपक कुमार सरोलिया ने इसमें आयोजित हुए कार्यक्रमों की जानकारी दी। राजभाषा अधिकारी श्री प्रेम प्रकाश पारीक ने विजेताओं के नामों की घोषणा की तथा मुख्य अतिथि ने उन्हें पुरस्कार प्रदान किए। प्रधान वैज्ञानिक डॉ. धुरेन्द्र सिंह ने कार्यक्रम के अंत में सभी आगन्तुकों को धन्यवाद ज्ञापित किया।

क्र.स.	प्रतियोगिता का नाम /वर्ग	विजेता		
		प्रथम	द्वितीय	तृतीय/सांत्वना
1	हिन्दी कविता वाचन प्रतियोगिता वैज्ञानिक वर्ग	डॉ. कमलेश कुमार	डॉ. अजय कुमार वर्मा	डॉ. सुशील कुमार महेश्वरी
	प्रशासनिक वर्ग	श्री राजेश कुमार दैया	श्रीमती पूजा जोशी	-----
	एसएसएस वर्ग	श्री महेश कुमार मीणा	श्री शिव लाल	-----
2	वैज्ञानिक शोध लेखन प्रतियोगिता	डॉ. पवन सिंह गुर्जर श्री रूप चंद बलाई	डॉ. अनीता मीणा	-----
3	हिन्दी टिप्पण लेखन प्रतियोगिता	श्री राकेश स्वामी	श्री राजेश दैया	श्री स्वरूप चंद राठौड़
4	हिन्दी आशुभाषण प्रतियोगिता	डॉ अजय कुमार वर्मा	डॉ. रामकेश मीणा	श्री शिवलाल
5	हिंदी शब्द ज्ञान प्रतियोगिता वैज्ञानिक वर्ग	डॉ. हनुमान राम	डॉ. अजय कुमार वर्मा	डॉ. कमलेश कुमार डॉ.किशनलाल कुमावत प्रोत्साहन
	तकनीकी वर्ग	श्री पृथ्वी राज सिंह	-----	-----
	प्रशासनिक वर्ग	श्री स्वरूप चंद राठौड़	श्रीमती पूजा जोशी	श्री राजेश दैया
	आर.ए तथा वाईपी वर्ग	श्री असीम आचार्य	श्री दिग्विजय सिंह	श्री राम किशन श्री लोकेश कुमार
6.	हिन्दी में सर्वाधिक कार्य करने पर नकद राशि पुरस्कार	श्रीमती पूजा जोशी, आशुलिपिक, पीएमई, प्रकोष्ठ श्री राजेश दैया, सहायक, वित्त एवं लेखा अनुभाग श्री स्वरूप चंद राठौड़, प्रश्रेलि, वित्त एवं लेखा अनुभाग श्री एच. एस. पटेल, सहायक, प्रशासनिक अनुभाग श्री गुल्लान राम, प्र.श्रे. लि., प्रशासनिक अनुभाग		

इसके अतिरिक्त संस्थान के अधिकारियों एवं कर्मचारियों के बच्चों के लिए पोस्टर प्रतियोगिता का आयोजन भी किया गया था। सभी बच्चों को पुरस्कार भी दिए गए थे।



हिन्दी पखवाड़े की कुछ झलकियां

### केन्द्रीय बागवानी परीक्षण केन्द्र वेजलपुर (गोधरा) में

संयुक्त हिन्दी कार्यशाला "राजभाषा नियमावली और कार्यान्वयन तथा संसदीय राजभाषा समिति की प्रश्नावली" दिनांक 12-13 सितम्बर, 2022 के दौरान श्री मनोज कुमार मुख्य तकनीकी अधिकारी (राजभाषा) की अध्यक्षता में केन्द्रीय बागवानी परीक्षण केन्द्र, वेजलपुर (गोधरा) में आयोजित किया गया।

संस्थान राजभाषा कार्यन्वयन समिति बैठक दिनांक 15 मार्च, 2022, 15 जून, 2022, एवं 19दिसम्बर, 2022 में केन्द्रीय बागवानी परीक्षण केन्द्र, वेजलपुर (गोधरा) द्वारा आनलाइन भाग लिया गया।

हिन्दी दिवस कार्यावयन में निर्णय लिया गया की सभी कर्मचारी एवं अधिकारियों अपना महत्तम कार्य हिंदी में ही करने का प्रयास करे।

### किसान प्रशिक्षण

केन्द्रीय बागवानी परीक्षण केन्द्र वेजलपुर पर आत्मा पोजेकट के सहयोग से गुजरात के कई गांव से पधारे

किसानो और महिला किसानो को "ग्रामिण विकास के लिए बागवानी" प्रशिक्षण कार्यक्रम का आयोजन किया गया। यह कार्यक्रम संपूर्ण हिन्दी में ही आयोजित किया गया था।



## 14. DISTINGUISHED VISITORS

Sh. Pramod Kumar, Supervisor, Agrizone Institute, Bikaner visited with Institute students on 25.05.2023.

Dr. Alok Kumar, Supervisor, Shekhawati Institute, Sikar visited with Institute students on 18.06.2022.

Sh. Karan Singh, Supervisor, Agripoint Jet Institute, Bikaner visit with Institute students on 15.07.2022

Sh. Kailash Kumar, LSA, Joint Director (Animal Husbandry) on 09.02.2022

Sh. Shankar Lal Jat, Deputy, PD, ATMA, Churu on 10.02.2022

Sh. Shravan Kumar, Veterinary Officer, Pasu Palan Vibhag, Sri Ganganagar on 03.03.2022

Sh. Karanjit Singh, Range Forest Officer, Training Range Pinjor, Panchkula, Haryana on 03.09.2022

Sh. Baljeet Singh, Instructor, Range Forest Officer, Pinjor, Haryana on 03.09.2022.

Dr. Nirmla Saini, Head, ARS, CSWRI, Bikaner on 30.08.2022

Dr. Vivek Kumar, Chairman, MDSL Jhunjhunu on 09.11.2022.

Dr. Arjun Lal Ola, A.P. College of Hort. & Forestry, CAU, Jhansi on 31.12.2022

Dr. Rajendra Singh Rathore, Assoc. Prof. & Comptroller of Examination, SKRAU, Bikaner on 05.05.2022

Dr. P. K. Yadav, Prof. & Head, Div. of Hort., SKRAU, Bikaner on 31.05.2022.

Dr. I. M. Verma, Former Prof., Div. of Hort., SKRAU, Bikaner on 20.10.2022.

Dr. Y. Sudershan, Former Head, SKRAU, Bikaner on 20.10.2022.

Dr. P. R. Meghwal, PS, CAZRI, Jodhpur on 20.10.2022.

Dr. Nisha Patel, PS, CAZRI, Jodhpur on 20.10.2022.

Dr. Maneesh Mishra, PS, CISH, Lucknow on 20.10.2022.

Dr. B. Singh, Vice Chancellor, ANDUAT, Ayodhya on 28.09.2022.

Dr. V. B. Patel, Principal Scientist, IARI, New Delhi on 28.09.2022.

Dr. P. Kalia, Former Head, IARI, New Delhi on 28.09.2022.

Dr. H. H Ram, Former Head, IARI, New Delhi on 28.09.2022.

Dr. A. K. Singh, Prof. BHU, Varanasi, on 29.09.2022

Dr. S. K. Garg, Vice Chancellor, RAJUVAS, Bikaner.

Dr. Jitendra Singh, Prof. & Head, Department of Hort., College of Horticulture & Forestry, Jhalawar on 28.09.2022.

Dr. O.P. Pareek, Former director, ICAR-CIAH, Bikaner on 01.10.2022

Sh. Suresh Kumar Dir.(Admn./CAo, SA) CAZRI on 18.05.2022

Sh. R.P. Varma A.O.DMAPR, Anand on 18.05.2022

Sh. Raghunathan R. A.O. (Rtd.) CMFRI. Cochi on 18.05.2022

Dr. M. Madhu Director, ICAR-IISWC, Dehradun Uttarakhand on 10.10.2022

Dr. H.P. Singh, Former D.D.G. (Hort) ICAR New Delhi on 19.12.2022

## 15. PERSONNEL

### (A) SCIENTIFIC POSTS

Sr. No.	Designation	Sanctioned Posts	Posts filled	Posts vacant
CIAH, Bikaner				
1.	Director (RMP)	01	00	Nil
2.	PS/HOD/HOD, RS	03	Nil	03
3.	Senior Scientist	07	04	03
4.	Scientist	24	19	05
<b>Total</b>		<b>35</b>	<b>24</b>	<b>11</b>
CHES, Vejalpur, Godhra				
1.	PS/HOD/HOD, RS	01	Nil	01
2.	Senior Scientist	01	01	Nil
3.	Scientist	08	04	04
<b>Total</b>		<b>10</b>	<b>05</b>	<b>05</b>
<b>Grand Total</b>		<b>45</b>	<b>29</b>	<b>16</b>

### (B) TECHNICAL POSTS

Name of Post	Sanctioned			In Position			Vacant		
	CIAH	CHES	Total	CIAH	CHES	Total	CIAH	CHES	Total
ACTO		01	01	-	-	-	-	01	01
STO	01	-	01	-	-	-	01	-	01
TO	02	-	02	-	-	-	02	-	02
STA	-	02	02	-	01	01	-	01	01
TA	04	03	07	02*	03*	05	01	01	02
Sr. Tech.	-	05	05	-	02	02	-	03	03
Tech.	07	17	24	06	14	20	01	03	04
<b>Total</b>	<b>14</b>	<b>28</b>	<b>42</b>	<b>08</b>	<b>20</b>	<b>28</b>	<b>05</b>	<b>09</b>	<b>14</b>

\*One incumbent of TA post of hq. ICAR -CIAH, Bikaner presently posted at r.s. CHES, Vejalpur, Godhra.

### (C) ADMINISTRATIVE POSTS

Name of Post	Sanctioned			In Position			Vacant		
	CIAH	CHES	Total	CIAH	CHES	Total	CIAH	CHES	Total
AO	01	Nil	01	01	Nil	01	Nil	Nil	Nil
FAO	01	Nil	01	01	Nil	01	Nil	Nil	Nil
AAO	01	01	02	01	Nil	01	Nil	01	01
P.S.	01	Nil	01	Nil	Nil	-	01	-	01
Assistant	07	01	08	03*	02*	05	03*	Nil*	03
P.A.	01	01	02	Nil	01	01	01	-	01
U.D.C.	03	02	05	03	01	04	-	01	01
Steno Grade - III	-	-	-	01 <sup>#</sup>	Nil	01 <sup>#</sup>	-	-	-
L.D.C.	04	02	06	-**	03**	03	03**	Nil**	03
<b>Total</b>	<b>19</b>	<b>07</b>	<b>26</b>	<b>10</b>	<b>07</b>	<b>17</b>	<b>08</b>	<b>02</b>	<b>10</b>

\*One incumbent (Sh. H.S. Patel) of Assistant Post of hq. ICAR-CIAH, Bikaner is presentally posted at r.s. CHES, Vejalpur, Godhra (Gujarat)

\*\*One incumbent of LDC post of hq. ICAR-CIAH, Bikaner is presentally poted at r.s. CHES, Vejalpur, Godhra (Gujarat)

<sup>#</sup> No post of Steno Grade-III in the revised cadre strength.

**(D) SKILLED SUPPORTING STAFF POSTS**

Name of Post	Sanctioned			In Position			Vacant		
	CIAH	CHES	Total	CIAH	CHES	Total	CIAH	CHES	Total
SSS	05	14	19	05	06	11	-	-	08
	-	41	41	Nil	36	36	-	-	05
	05	55	60	05	42	47	-	-	13

**SCIENTIFIC STAFF:**

S. No.	Name	Designation	Discipline	Pay Scale
1	Dr. Dilip Kumar Samadia	Principal Scientist	Horticulture	Level-14
2	Dr. Dharendra Singh	Principal Scientist	Biotechnology (Plant Science)	Level-14
3	Dr. Shushil Kumar Maheshwari	Principal Scientist	Plant Pathology	Level-14
4	Dr. Shiv Ram Meena	Principal Scientist	Agril. Extension	Level-14
5	Dr. Mukesh Kumar Jatav	Principal Scientist	Soil Science	Level-14
6	Dr. Deepak Kumar Sarolia	Principal Scientist	Fruit Science	Level-14
7	Dr. Balu Ram Choudhary	Principal Scientist	Horticulture-Vegetable Science	Level-14
8	Dr. Ramkesh Meena	Senior Scientist	Horticulture-Fruit Science	Level-13A
9	Dr. Mukesh Kumar Berwal	Senior Scientist	Plant Biochemistry	Level-13A
10	Dr. Ramesh Kumar	Senior Scientist	Hort.-Floriculture	Level-13A
11	Dr. Ram Prasanna Meena	Senior Scientist	Plant Pathology	Level-12
12	Sh. Roop Chand Balai	Scientist	Soil Science	Level-13A
13	Dr. Chet Ram	Scientist	Agril. Biotechnology	Level-11
14	Dr. Anita Meena	Scientist	Soil Science	Level-11
15	Sh. Jagan Singh Gora	Scientist	Fruit Science	Level-11
16	Dr. Kishan Lal Kumawat	Scientist	Fruit Science	Level-11
17	Dr. Pawan Singh Gurjar	Scientist	Fruit Science	Level-11
18	Sh. Lal Chand	Scientist (on study leave)	Fruit Science	Level-11
19	Dr. Kamlesh Kumar	Scientist	Fruits Science	Level-11
20	Dr. Ajay Kumar Verma	Scientist	Vegetable Science	Level-11
21	Dr. Hanuman Ram	Scientist	Vegetable Science	Level-11
22	Dr. Pawan Kumar	Scientist	Genetics & Plant Breeding	Level-10
23	Sh. Mahendra Kumar Choudhary	Scientist	Genetics & Plant Breeding	Level-10

**CHES, Vejalpur**

S.No.	Name	Designation
1.	Dr.A.K.Singh	Principal Scientist (Hort.) & I/c Head
2.	Dr.V.V.Appa Rao	Principal Scientist (Soil Science)
3.	Dr.D.S.Mishra	Principal Scientist (Hort.)
4.	Dr. Lalu Prasad Yadav	Scientist –Sr.Scale (Veg. Science)
5.	Dr. Gangadhara K.	Scientist –Sr. Scale (Veg. Science)

**TECHNICAL STAFF:****CIAH, Bikaner**

S.No.	Name	Designation
1.	Sh. P. P. Pareek	ACTO
2.	Sh. Sanjay Patil	ACTO
3.	Sh. Bhoj Raj Khatri	STO
4.	Sh. P. R. Singh	TO
5.	Sh. Ashok Kumar	TO
6.	Sh. Birdi Chand Meena	TA
7.	Sh. Sual Lal	Sr. Technician
8.	Sh. C. D. Rathava	Technician

**CHES, Vejalpur**

S.No.	Name	Designation
9.	Sh.G.U.Trivedi	Asstt. Chief Technical Officer (Library)
10.	Sh.A.V.Dhobi	Senior Technical Officer (overseer)
11.	Sh.K.K.Vankar	Technical Officer (Field)
12.	Sh.G.R.Barua	Senior Technical Officer (Field)
13.	Sh.R.B.Barua	Technical Officer (Field)
14.	Sh.R.D.Rathva	Technical Officer (Lab.)
15.	Sh.C.S.Chamar	Technical Officer (Field)
16.	Sh.K.V.Parmar	Technical Officer (Lab.)
17.	Sh. D.C.Joshi	Technical Officer (Field)
18.	Sh.D.P.Patel	Technical Officer (Field)
19.	Sh.B.R.Barua	Technical Officer (Lab)
20.	Sh A.J.Soalnki	Technical Officer (Field)
21.	Sh K.M.Parmar	Technical Officer (Mach.)
22.	Sh.B.F.Patelia	Technical Officer (Field)
23.	Sh.B.V Rathva	Technical Officer (Lab)

**NEW ENTRANTS**

1. Dr. Ram Prasanna, Senior Scientist (Plant Pathology) joined on 11/04/2022 on transfer from ICAR DMAPR, Boriavi, Anand.
4. Sh. Bharat Kumar Acharya joined to the post of Finance & Accounts Officer of the Institute on 18.06.2022 on promotion

**PROMOTION :****SCIENTISTS**

S. No.	Name of the Sr. Scientist	Placed/promoted to the next higher grade of	Date of placement
1.	Dr. Balu Ram Choudhary	Principal Scientist in the pay scale of Rs.37400 - 67000+RGP of Rs.10000/ -(Pre-revised)/Research Level 14 (vide order dated 05.1.2022)	27-06-2020

क्रम सं.	वैज्ञानिक विवरण (नाम / पदनाम)	समितियों की अनुशंसा पर सक्षम प्राधिकारी का निर्णय / अनुमोदन
1.	Dr. Ramkesh Meena Senior Scientist (Horticulture-Fruit Science)	Promotion of the Scientist to the next higher grade of PB – 4 [Rs. 37,400 – 67,000 + RGP of Rs. 9000/- (Revised Research Pay Level – 13A)] w.e.f. 06.06.2020.
2.	Dr. Vijay Rakesh Reddy S., Scientist (Fruit Science) (Consequent upon his transfer now working at ICAR-IIHR, Bengaluru)	Promotion of the Scientist to the next higher grade in PB – 3 [Rs. 15,600 – 39,100 + RGP of Rs. 7000/- (Revised Research Pay Level – 11)] w.e.f. 01.07.2019.
3.	Dr. Kamlesh Kumar Scientist (Fruit Science)	Promotion of the Scientist to the next higher grade in PB – 3 [Rs. 15,600 – 39,100 + RGP of Rs. 7000/- (Revised Research Pay Level – 11)] w.e.f. 01.01.2020.
4.	Sh. Lal Chand Scientist (Fruit Science)	Promotion of the Scientist to the next higher grade in PB – 3 [Rs. 15,600 – 39,100 + RGP of Rs. 7000/- (Revised Research Pay Level – 11)] w.e.f. 01.01.2020.
5.	Dr. Gangadhara K. Scientist (Vegetable Science)	Promotion of the Scientist to the next higher grade in PB – 3 [Rs. 15,600 – 39,100 + RGP of Rs. 7000/- (Revised Research Pay Level – 11)] w.e.f. 01.07.2019.
6.	Dr. Ajay Kumar Verma Scientist (Vegetable Science)	Promotion of the Scientist to the next higher grade in PB – 3 [Rs. 15,600 – 39,100 + RGP of Rs. 7000/- (Revised Research Pay Level – 11)] w.e.f. 01.01.2020.
7.	Dr. Hanuman Ram Scientist (Vegetable Science)	Promotion of the Scientist to the next higher grade in PB – 3 [Rs. 15,600 – 39,100 + RGP of Rs. 7000/- (Revised Research Pay Level – 11)] w.e.f. 05.07.2021.
8.	Dr. Chet Ram Scientist (Biotechnology)	Promotion of the Scientist to the next higher grade in PB – 3 [Rs. 15,600 – 39,100 + RGP of Rs. 7000/- (Revised Research Pay Level – 11)] w.e.f. 12.02.2016.

क्रम सं.	वैज्ञानिक का विवरण (नाम / पदनाम)	समितियों की अनुशंसा पर सक्षम प्राधिकारी का निर्णय/ अनुमोदन
1.	Dr. Shravan Manbhar Haldhar, Senior Scientist (Agricultural Entomology)	Promotion to the next higher grade of Senior Scientist in PB – 4 of Rs. 37,400 – 67,000 + RGP of Rs. 9000/ - (Revised Research Pay Level – 13A) w.e.f. 15.12.2021.
2.	Dr. Mukesh Kumar Berwal, Senior Scientist (Plant Biochemistry)	Promotion to the next higher grade of Senior Scientist in PB – 4 of Rs. 37,400 – 67,000 + RGP of Rs. 9000/ - (Revised Research Pay Level – 13A) w.e.f. 10.02.2022.
3.	Dr. Ramesh Kumar Senior Scientist (Hort – Floriculture)	Promotion to the next higher grade of Senior Scientist in PB – 4 of Rs. 37,400 – 67,000 + RGP of Rs. 9000/ - (Revised Research Pay Level – 13A) w.e.f. 10.02.2022.



**ADMINISTRATIVE**

Sl.No.	Name of officer	Place of posting as U.D.C.	Date of joining as U.D.C.
1.	Smt. D.B. Patel	ICAR-CIAH, Regional Station, Vejalpur	5.2.2022 (A/N)

Sl.No.	Name of officer	Date of joining as U.D.C.
1.	Sh. S.C. Rathore	16.03.2022
2.	Sh. Gulla Ram	24.03.2022 (A.N.)

- Sh. Patani Vijaykumar Rameshbhai, Stenographer-Grade-III, KVK -Panchmahal, Vejalpur (Gujarat) promoted to the post of Personal Assistant at ICAR-CIAH R.S. (CHES), Vejalpur (Guj.) w.e.f. 28.04.2022.
- Shri P.V. Nayak, Sr. Clerk, CHES, Vejalpur (Godhra) appointed on the post of Assistant in the Level 6, Pay Band-2 Rs.9300-34800 with Grade Pay of Rs.4,200/- (pre-revised) on transfer-cum-promotion basis at ICAR -Central Institute for Arid Horticulture, Bikaner (Rajasthan) w.e.f. 19<sup>th</sup> December, 2022 (Forenoon)

**TECHNICAL**

1. Granted merit promotion to Sh. Sanjay Patil, Artist -cum-Photography (T-6) to the next higher-grade ACTO (T.7-8) of Category III of TSR in the pay of Level 11 w.e.f. 30.11.2016.

Sl. No.	Name of the employee	Designation/ Grade in which initially appointed and date of appointment	Designation/Grade & date to which placed
1.	Shri Kamlesh Kumar Muljibhai Parmar	T-3/Programme Assistant (Computer) 29.07.2009	Sr. Technical Assistant/ Programme Assistant (Computer)/T-4 29.07.2009
2.	Shri Purthvisinh Sumantsinh Gohil	T-3/Programme Assistant (Laboratory Technician) 13.08.2009	Sr. Technical Assistant/ Programme Assistant (Lab. Technician)/T-4 13.08.2009

3. Granted merit promotion to Sh. Chhuttan Lal Meena, Sr. Technical Officer (Field) (T -6) to the next higher-grade ACTO (T.7-8) of Category III of TSR in the pay of Level 11 w.e.f. 13.7.2018.
4. Granted merit promotion to Sh. A.V. Dhobi, Sr. Technical Officer (Overseer) (T -6) to the next higher-grade ACTO (T.7-8) of Category III of TSR in the pay of Level 11 w.e.f. 5.12.2017.
5. Granted merit promotion to Sh. R.B. Baria, Technical Officer (Field) (T -5) to the next higher-grade STO (T-6) of Category III of TSR in the pay of Level 10 w.e.f. 8.8.2017.
6. Granted merit promotion to Sh. Bhoj Raj Khatri, Technical Officer (Computer) (T -5) to the next higher-grade STO (T-6) of Category III of TSR in the pay of Level 10 w.e.f. 29.03.2019.
7. Granted merit promotion to Sh. Ashok Kumar Mali, Senior Technical Assistant (Driver) (T -4) to the next higher-grade Technical Officer (Driver) (T -5) of Category II of TSR in the pay Level 7 w.e.f. 29.06.2021.

1. 33 CL(TS) regularized to the post of Skilled Supporting Staff.
2. 07 CL(TS) regularized to the post of Skilled Supporting Staff.

### **MODIFIED ASSURED CAREER PROGRESSION SCHEME (MACPS)**

Sl. No.	Name of Official with designation	Existing Pay Level in Pay Matrix	Date of grant of 1 <sup>st</sup> /2 <sup>nd</sup> Financial Up-gradation and Level in Pay Matrix
1.	Sh. Patani Vijay kumar Rameshbhai Stenographer-III	Level-4 (Pre-revised PB -1 Rs.5200-20200 + GP 2400)	28.07.2019 1 <sup>st</sup> Financial Up-gradation Level-5 (Pre-revised PB-1 Rs.5200-20200 + GP 2800)
2.	Shri Swaroop Chand Rathore LDC	Level-3 (Pre-revised PB -1 Rs. 5200-20200+GP 2000)	13.04.2018 2 <sup>nd</sup> Financial Up-gradation Level-4 (Pre-revised PB-1 Rs.5200-20200 + GP 2400)

Sl. No.	Name of Official with designation	Existing Pay Level in Pay Matrix	Date of grant of 2 <sup>nd</sup> Financial Up-gradation and Level in Pay Matrix
1.	Shri Mahesh Kumar Meena, SSS	Level-2 (Pre-revised PB -1 Rs 5200 - 20200+GP 1900)	31.12.2019 Level-3 (Pre-revised PB -1 Rs 5200 -20200+GP 2000)

Sl. No.	Name of Official with designation	Existing Pay Level in Pay Matrix	Date of grant of 1 <sup>st</sup> /3 <sup>rd</sup> Financial Up-gradation and Level in Pay Matrix
1.	Sh. Rakesh Kumar Swami Assistant	Level-6 (Pre-revised PB -2 Rs.9300-34800 GP 4200)	02.04.2022 3 <sup>rd</sup> Financial Up-gradation Level-7 (Pre-revised PB -2/9300-34800 Grade Pay of Rs.4600)
2.	Smt. Pooja Joshi Stenographer-III	Level-4 (Pre-revised PB -1 Rs.5200-20200 GP 2400)	25.05.2022 1 <sup>st</sup> Financial Up-gradation Level-5 (Pre-revised PB -1 Rs.5200 -20200 + GP 2800)

1. Dr. D.K. Samadia, Principal Scientist has taken over the charge of the Director (Acting), ICAR - CIAH, Bikaner in the afternoon of 31.05.2022.

### **PROBATION CLEARANCE & CONFIRMATION**

Confirmed the services of Sh. Chandubhai D. Rathva, Technician (Field) against the post of Technician (Field) in the Pay Band 5200 -20200 Grade Pay Rs.2000 (Pre Revised) w.e.f. 31.10.2019 on satisfactory completion of probation period of two years.

Sl. No.	Name of Scientist & discipline	Place of posting	Date of joining/ appointment to the post	Date from which probation cleared	Date of confirmation in the Scientist grade of ARS
1.	Dr. Pawan Kumar, Scientist (Genetics & Plant Breeding)	ICAR-CIAH, Bikaner	02.07.2018 (F/N)	01.07.2020	02.07.2020

Sl. No.	Name of Scientist	Date of appointment	Date of probation period clearance	Date of confirmation in the grade of Scientist
1.	Sh. Hanuman Ram Scientist (Vegetable Science)	05.07.2017	04.07.2019	05.07.2019

S.No.	Name of Officer	Place of posting	Date of appointment as Administrative Officer	Date of Satisfactory completion of probation in the grade of AO	Date of confirmation in the grade of AO
1.	Sh. Ramesh	CIAH, Bikaner	08.08.2019	07.08.2021	08.08.2021

Sr. No.	Name of the Scientist	Date of Appointment	Date from which probation cleared	Date of confirmation in the Scientist grade of ARS
1.	Dr. Rajkumar Scientist (Fruit Science) [Presently working at ICAR-CSSRI, Karnal]	01.01.2013 (F.N.)	31.12.2014	01.01.2015

### **JOINING ON TRANSFER/PROMOTION/APPOINTMENT**

1. Dr. Ram Prasanna, Senior Scientist (Plant Pathology) joined on 11/04/2022 on transfer from ICAR-DMAPR, Boriavi, Anand.
2. Sh. Bharat Kumar Acharya joined to the post of Finance & Accounts Officer of the Institute on 18.06.2022 on promotion.

### **RELIEVING ON PROMOTION/APPOINTMENT/TRANSFER/DEPUTATION**

1. Sh. H.S. Patel, Assistant relieved in the afternoon of 21.11.2022 on transfer to regional station CHES, Vejalpur, Godhra (Gujarat).
2. Sh. P.V.Nayak promoted to the post of Assistant at ICAR-CIAH, Bikaner from ICAR-CIAH, Regional Station, CHES, Vejalpur w.e.f. 16.12.2022

**SUPERANNUATION/RETIREMENT**

1. Sh. Nihal Singh, Chief Technical Officer retired on superannuation from the Council's services in the afternoon of 31.03.2022.
3. Sh. H.R. Vankar, Skilled Supporting Staff retired on superannuation from the Council's services in the afternoon of 31.03.2022.
4. Sh. F.T. Patel, Skilled Supporting Staff retired on superannuation from the Council's services in the afternoon of 30.04.2022.
5. Dr. B.D. Sharma, Principal Scientist & Director (Acting) retired on superannuation from the Council's services in the afternoon of 31.05.2022.
6. Sh. B.M. Patelia, Technical Officer retired on superannuation from the Council's services in the afternoon of 31.05.2022.
7. Sh. S.J. Patel, Skilled Supporting Staff retired on superannuation from the Council's services in the afternoon of 31.05.2022.
8. Sh. G.K. Chauhan, Skilled Supporting Staff retired on superannuation from the Council's services in the afternoon of 31.05.2022.
9. Sh. G.F. Chauhan, Skilled Supporting Staff retired on superannuation from the Council's services in the afternoon of 31.10.2022
10. Sh. D.S. Rawat, Skilled Supporting Staff retired on superannuation from the Council's services in the afternoon of 31.12.2022.
11. Sh. F.P. Chauhan, Skilled Supporting Staff retired on superannuation from the Council's services in the afternoon of 31.12.2022.

**RESIGNATION**

--

**OBITUARY**

1. Sh. Chhuttan Lal Meena, Assistant Chief Technical Officer, ICAR-CIAH, Bikaner expired on 26.07.2022.

## 16. BUDGET

### Government Grant

(Rs in Lakhs)

Head	Budget Estimate	Revised Estimate	Expenditure (upto 23.2.2023)
	<b>CIAH, Bikaner</b>		
Grant in Aid – Salaries	1600.00	1584.93	1409.82
Grant in Aid – General (Pension & Retirement Benefits)	386.00	386.00	215.92
Grant in Aid General (excluding Pension & retirement Benefits)	300.00	300.00	282.09
Grant in Aid – Capital	30.00	30.00	9.99
Grant in Aid General (1270)	0.00	30.00	3.00
<b>Total</b>	<b>2316.00</b>	<b>2330.93</b>	<b>1920.82</b>
<b>SCSP (CIAH)</b>			
Grant in Aid General (excluding Pension & retirement Benefits)	10.00	20.00	10.18
Grant in Aid – Capital	2.00	2.00	0.23
<b>Total</b>	<b>12.00</b>	<b>22.00</b>	<b>10.41</b>
<b>TSP (CIAH)</b>			
Grant in Aid General (excluding Pension & retirement Benefits)	25.00	25.00	1.46
Grant in Aid – Capital	0.00	0.00	0.00
<b>Total</b>	<b>25.00</b>	<b>25.00</b>	<b>1.46</b>
<b>AICRP on AZF</b>			
Grant in Aid – Salaries	660.00	458.00	458.00
Grant in Aid General (excluding Pension & retirement Benefits)	135.00	135.00	132.50
Grant in Aid – Capital	0.00	0.00	0.00
<b>Total</b>	<b>795.00</b>	<b>593.00</b>	<b>590.50</b>
<b>SCSP (AICRP on AZF)</b>			
Grant in Aid General (excluding Pension & retirement Benefits)	10.00	10.00	10.00
Grant in Aid – Capital	0.00	0.00	0.00
<b>Total</b>	<b>10.00</b>	<b>10.00</b>	<b>10.00</b>
<b>TSP (AICRP on AZF)</b>			
Grant in Aid General (excluding Pension & retirement Benefits)	5.00	5.00	5.00
Grant in Aid – Capital	0.00	0.00	0.00
<b>Total</b>	<b>5.00</b>	<b>5.00</b>	<b>5.00</b>

### Revenue Generation

(Amount in Rs.)

S. No.	Head of Account	Amount
1	Sale of farm produce	2998300
2	Sale of vehicle, other machine tools	25000
3	Licence fee	76646
4	Interest earned on loans & advances	285800
5	Unspent balance of Grants of previous years	4752825
6	Interest earned on short term deposits	512265
	a) Consultancy	30000
7	Recoveries of Loans & Advances	46680
	<b>Total</b>	<b>8727516.00</b>

## 17. SEED AND PLANTING MATERIAL (JAN-DEC.-2022)

### CIAH, Bikaner

#### Fruits and native crop-plant and planting material during 2022 at ICAR-CIAH, Bikaner

S.N.	Name of crop plants	Number of plants produced	Total plant sold (No.)
1.	Pomegranate	700	1059
2.	Lemon	450	783
3.	Lasoda	300	973
4.	Karonda	800	1553
5.	Phalsa	1600	1545
6.	Aonla	1000	208
7.	Khejri	65000	10759
8.	Ber	5000	2232
9.	Bael	4200	568
10.	Kinnow	200	10
11.	Masami	300	24
12.	Mulberry	500	674
13.	Jamun	800	253
14.	Moringa	50	544
15.	Fig	10	359
16.	Brinjal		50
17.	Tomato		50
18.	Aloe		840
19.	Bud stick	--	260
20.	Cactus		220
21.	Ker		8
22.	<b>Total</b>	<b>80910</b>	<b>22972</b>

### ICAR-CIAH Regional Station, CHES, Vejalpur

#### CHES, NURSERY

Sr. No.	Name of plants	Number of plants produced	Number of plants sold
1.	Sapota plants	03	03
2.	Ber Plants	05	05
3.	Custard Apple Budded	160	155
4.	Rayan Plants	01	01
5.	Kagzi Lime Air layer	490	457
6.	Aonla Plants	674	674
7.	Chironji Seedling	15	11
8.	Bael Budded	1556	1556
9.	Jamun Budded	1100	1070
10.	Mango Plants grafted	3086	3024
11.	Guava Budded	845	833
12.	Karonda seedling	348	288
13.	Pomegranate plants	68	62
14.	Acid Lime plants	350	125
15.	Tamarind Budded	14	14
16.	Lasoda seedlings	05	05
17.	Bud sticks	290	290
18.	Drumstick	10	02
	<b>Total.</b>	<b>9020</b>	<b>8573</b>

**RFS Nursery**

Sr. No.	Name of plants	Number of plants produced	Number of plants sold
1.	Custard Apple Budded	480	471
2.	Bael Budded	195	192
3.	Mango Plants grafted	5539	5497
4.	Jamun Budded	395	367
5.	Acid Lime plants	2107	1867
6.	Guava Budded	318	318
7.	Karonda Seedlings	640	500
8.	Aonla Plants	255	255
9.	Mahuva Seedlings	04	04
10.	Kagzi Lime Air layer	267	255
11.	Lasoda seedlings	152	152
12.	Tamarind Budded	21	21
13.	Pomegranate plants	05	05
14.	Wood Apple Plants	02	02
15.	Tamarind plants	02	02
	<b>Total.</b>	<b>10382</b>	<b>9908</b>

Total plants produced: 9020+10382=19402.00 and sale 8573+9908=18661.00

**Vegetable CIAH, Bikaner****ICAR-CIAH**

Sr. No.	Name of Seeds	Seed produced (kg)	Seed sold (kg)
1.	Snapmelon AHS-82	36	16.3
2.	Bottle gourd- Thar Samridi	11.0	10.5
3.	Cluster bean-Thar Bhadvi	112.0	106.0
4.	Palak-Thar Hariparna	20.0	5.5
5.	Sponge gourd- Thar Tapis	27.0	9.4
6.	Brinjal- Thar Rachit	0.800	1.2
7.	Kachri AHK-119	32.50	29.9
8.	Longmelon- Thar sheetal	6.00	1.6
9.	Ridge gourd- Thar karni	3.0	1.8
10.	Muskmelon- AHMMBR-47	1.30	2.7
	Total	249.6	184.9

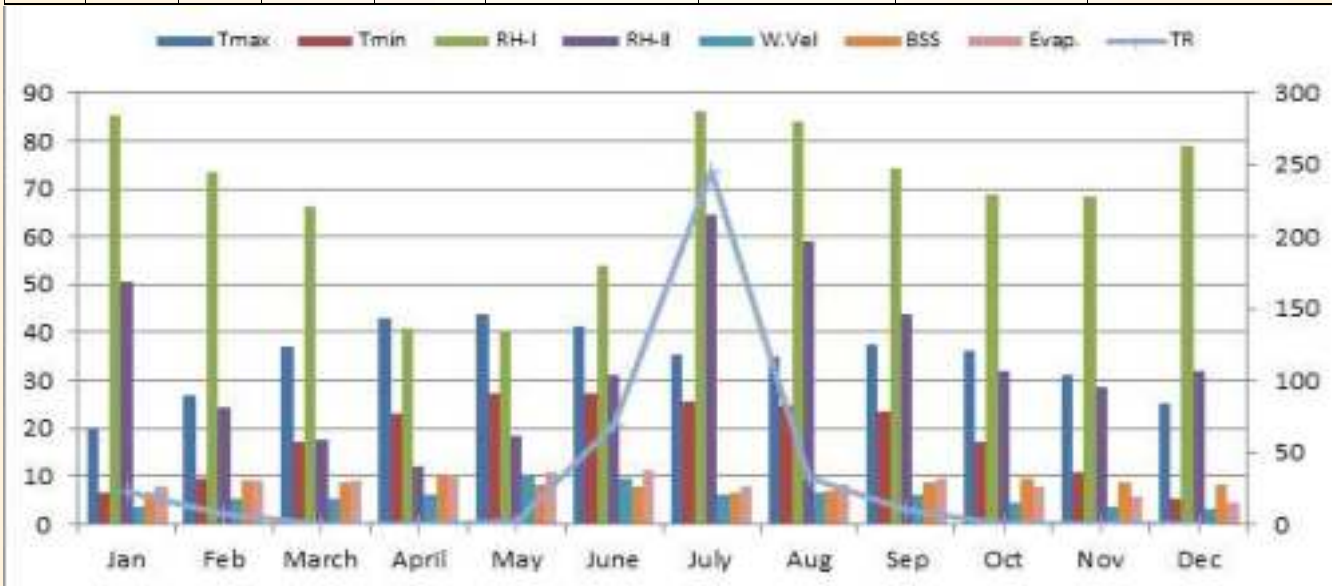
**CHES, Vejalpur**

Sr. No.	Name of plants / seeds	Seed produced (kg)	Seed sold (kg)
1.	Moringa seeds	14.5	3.810
2.	Bottle gaurd seeds	48.0	34.811
3.	Pumpkin seeds	1.5	0.350
4.	Tomato seeds	1.0	0.320
5.	Cowpea seeds	5.0	0.500
6.	Dolichosbean seeds	50.0	0.750
	Total	120.00	40.541

### 18. METEOROLOGICAL DATA

#### CIAH, Bikaner

Month	Temperature (°C)		Relative Humidity (%)		Wind velocity (km/h)	Bright sun shine (h)	Total rainfall (mm)	Evapo-transpiration (mm)
	Tmax	Tmin	RH-I	RH-II				
Jan	20.27	6.44	85.39	50.68	3.51	6.65	22.60	7.68
Feb	26.74	9.62	73.34	24.34	5.16	9.08	7.40	9.14
March	36.92	16.98	66.26	17.68	5.42	8.87	0.00	9.26
April	42.92	22.98	40.83	12.10	6.38	9.83	0.00	10.20
May	43.97	27.25	40.58	18.39	9.84	8.29	1.20	10.87
June	41.09	27.49	53.80	31.30	9.51	8.06	69.40	11.30
July	35.31	25.47	86.10	64.39	6.16	6.66	244.90	7.71
Aug	35.12	24.62	84.03	58.81	6.68	7.10	33.20	8.26
Sep	37.63	23.52	74.43	43.73	6.14	8.85	9.40	9.50
Oct	36.02	17.24	68.65	31.81	4.40	9.64	0.00	7.68
Nov	31.22	10.91	68.10	28.57	3.43	8.87	0.00	5.70
Dec	25.27	5.14	78.84	31.77	3.08	8.12	0.00	4.35



Monthly weather data recorded at Automated Weather System observatory at KVK Panchmahal.

Month	Rainfall (MM)	Rainy Day	Temperature (°C)		Relative Humidity (%)		Sunshine (Hours)
			Min.	Max	Min.	Max.	
Jan-22	0	-	11.3	27.1	35.16	89.94	7.58
Feb-22	0	-	12.3	31.8	23.75	74.71	9.14
Mar-22	0	-	18.2	38.3	13.13	68.03	8.91
Apr-22	0	-	22.0	41.4	11.87	77.47	7.50
May-22	0	-	27.4	40.7	22.81	83.55	5.58
Jun-22	85.5	4	27.4	38.2	37.30	89.97	4.81
Jul-22	220	24	25.5	31.8	72.29	99.65	2.42
Aug-22	141	13	25.4	31.8	71.26	99.94	3.28
Sep-22	162	6	24.9	33.2	63.07	100.00	5.30
Oct-22	123.5	2	20.1	34.4	39.97	99.58	8.42
Nov-22	5.5	1	14.6	33.1	26.83	98.13	8.99
Dec-22	0	-	14.8	30.5	35.29	92.87	8.17







हर कदम, हर टनर  
किसानों का हमसाफर  
भारतीय कृषि अनुसंधान परिषद

*AgriSearch with a human touch*



एक कदम स्वच्छता की ओर