ANNUAL REPORT
1995-96

ICAR

NATIONAL RESEARCH CENTRE FOR ARID HORTICULTURE

BIKANER-334003 (RAJASTHAN), INDIA

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Citation

NRC for Arid Horticulture,
Annual Report for 1995-96

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Cover Photographs

Front : Proposed Building of NRCAH, Bikaner
Back : Top : Automatic Weather Station
Bottom : Water Reservior at NRCAH Farm

CONTENTS

Introduction

The hot arid region occupies nearly 12% land surface of India in the States of Rajasthan, Gujarat, Haryana, Punjab, Andhra Pradesh, Karnataka and Maharashtra. The production of horticultural crops in this region is confined to a few small pockets having irrigation water. It is now realised that horticultural crops particularly perennial fruit trees, not only provide nutrition and income security to the people but can also ameliorate the harsh environment of the arid region. However, the geophysical and agroclimatological constraints for production of these crops in arid areas necessitiated development of special production technologies. Since the available research set up for this purpose in the State Agricultural Universities and in the Institutes of the ICAR was inadequate, the Indian Planning Commission as recommended by the Working Group on Agricultural Research and Education, approved the establishment of National Research Centre for Arid Horticulture (NRCAH) during the Seventh Five Year Plan.

Background

On approval of the Planning Commission for establishment of NRCAH, the Task Force constituted by the ICAR in 1987 recommended to locate the NRCAH in arid part either of Rajasthan or Gujarat.

The ICAR, Site Selection Committee in July, 1989 recommended establishment of the NRCAH at the site offered by Government of Rajasthan at Bikaner on NH 15 alternate site offered by the Rajasthan Agricultural University and endorsed by the Government of Rajasthan in Chak No. 1-2 BKM, 489.900 R.D. (R) and 493.900 R.D. (R) was taken into possession.

To make the Centre functional, Project Coordinator, All India Coordinated Research Project on Arid Zone Fruits (AICRP on AZF) located at CCS HAU, Hisar was assigned additional duties of its Officer on Special Duty (OSD) in November, 1990. After the land identified for the establishment of NRCAH, the Project Coordinator along with Coordination Unit of AICRP on AZF was shifted from Hisar to Bikaner in March, 1993 and merged with NRCAH.

Mandate

To conduct mission oriented research for improvement in productivity of horticultural crops and development of horticulture - based cropping system under arid environment; and to act as a repository of information related to arid horticulture.

Mission/Objectives

* To introduce, collect, characterize, conserve and evaluate the biodiversity of horticultural crops under arid environment.

* To utilize the available biodiversity and improve the target fruit crops such as ber, pomegranate, aonla, date palm and cucurbitaceous, leguminous and solanaceous vegetables 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 agrotechniques 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 ecophysiological parameters of cropping system models for utilization of high temperature and radiation resources.

* To develop postharvest 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.

Physiography

The site of the Centre at Bikaner is located on NH 15 (Bikaner- Ganganagar) which lies in Arid Western Zone, 28° N latitude, 73° 18'E longitude and altitude of 234.84m above mean sea level. The Centre is at a distance of 10 km from Bikaner city and 13 km from Bikaner railway station. Its research farm is spread over an area of 124.58 hectares.

Soil

The soil of the research farm belongs to the order Aridisol and is sandy desertic, very poor in fertility and water holding capacity, having pH 8.3 to 8.5, ECe 0.1 to 0.15 dSm^{-1} and 0.08 to 0.09% organic carbon.

Climate

The rainfall is confined to the period between July and September with 19-21 rainy days out of 21-31 in the whole year resulting both in soil moisture and atmospheric water stress to the plants after the rainy season. The precipitation is not only low (247mm) but is also erratic resulting in frequent droughts. The potential evapotranspiration (PET) is 1772.4 mm with a moisture index value of -84.2. The occurrence of high wind speed, intense solar radiation and frost are common. The mean monthly minimum temperature is 2°C during January and the mean monthly maximum temperature during May is 45°C.

Progress in Research

1.1 Collection, conservation, characterization and evaluation of *Khejri* (*Prosopis cineraria*) types.

Two hundred germplasm accessions of *Khejri* identified from 11 districts of Rajasthan exhibited variability in canopy size, branching pattern, level of spines, foliage density, colour of bark and foliage, shape, size, colour, maturity period of pods and shape, size, colour and number of seeds. The ripe pods were collected at the time of survey (May-June, 1995). Considering the horticultural utility, nearly 80 genotypes seem to be promising.

Immature green pods of 30 promising types from Bikaner and adjoining areas collected at unripe stage, suitable for vegetable purpose, have shown variation with respect to pod length, thickness, appearance, tenderness, taste, number of seeds, seed weight, etc. Positive scoring on 9 point scale (Table 1) has given a clue to select horticulturally important ones.

Table 1 : Quality rating (score) of some *Prosopis cineraria* pods for vegetable purpose

Genotype	Length	Thickness	Appearance	Tenderness	Taste	No. of seeds per pod	Av. wt. per seed	Av. score	Final rating
1	7	9	9	9	6	8	8	7.6	LM
2	8	5	5	9	7	8	8	7.1	LM
3	8	6	8	8	7	9	6	7.5	LM
4	8	4	4	4	7	9	7	6.1	LS
5	4	8	5	9	7	7	—	6.6	LS
6	4	7	7	3	8	9	9	6.7	LS
7	5	5	5	3	7	7	5	5.8	NLND
8	4	5	1	1	7	6	7	4.3	DS
9	5	4	5	4	7	5	6	5.1	NLND
10	8	5	5	8	6	9	7	6.9	LS
11	5	4	8	6	8	5	5	5.9	NLND
12	5	5	3	1	3	9	7	4.7	DS
13	8	4	8	8	8	8	4	6.9	LS
14	1	4	1	9	9	1	4	4.1	DS
15	5	6	3	9	7	4	7	5.9	NLND
16	7	4	1	6	7	6	8	5.4	NLND
17	7	4	5	9	7	8	6	6.6	LS
18	5	4	2	5	7	5	6	4.9	DS
19	5	7	3	9	6	7	7	6.4	LS
20	7	5	7	9	6	7	7	6.9	LS
21	9	4	5	8	7	9	5	6.7	LS
22	7	5	8	9	6	9	6	7.0	LM
23	6	3	4	8	7	7	5	5.7	NLND
24	5	5	4	4	7	9	8	6.0	LS
25	4	5	1	8	7	8	7	5.7	NLND
26	4	7	1	9	8	8	8	6.4	LS
27	6	5	2	9	8	8	8	6.6	LS
28	8	4	5	6	7	9	6	6.4	LS
29	7	2	8	9	9	6	4	6.4	LS
30	5	3	7	8	8	7	8	6.6	LS

LM - Liked moderately, LS - Liked slightly, NLND - Neither liked nor disliked
DS - Disliked slightly,

Seeds of 200 germplasm accessions collected during the survey alongwith 171 types (163 from other parts of Rajasthan and 8 from Haryana) received from NBPGR, Jodhpur have been raised for evaluation. Freshly collected seeds have resulted in higher seed germination.

Plant propagation

Preliminary observations indicate that *Khejri* is highly cross pollinated and has slow growing habit. To maintain true to type plants having better growth, flowering and fruiting characters, vegetative propagation is required.

Cuttings of one year old shoots treated with IAA, IBA and NAA 3000-6000 ppm alone or in combination with thiamine (Table 2) sprouted during February, but withered after one and a half months due to lack of root development.

Table 2 : Effect of plant growth regulators on sprouting of *Prosopis cineraria* cuttings

TREATMENT	% SPROUTING	TREATMENT	% SPROUTING
IAA 1000 ppm	8	IBA 6000 + Thiamine 6000 ppm	16
IAA 3000 ppm	8	IBA 1000 + NAA 1000 + Thiamine 1000 ppm	8
IAA 6000 ppm	0	IBA 3000 + NAA 3000 + Thiamine 3000 ppm	24
IAA 1000 + Thiamine 1000 ppm	0	IBA 6000 + NAA 6000 + Thiamine 6000 ppm	16
IAA 3000 + Thiamine 3000 ppm	0	NAA 1000 ppm	16
IAA 6000 + Thiamine 6000 ppm	0	NAA 3000 ppm	24
IAA 1000 + IBA 1000 + Thiamine 1000 ppm	8	NAA 6000 ppm	16
IAA 1000 + IBA 3000 + Thiamine 3000 ppm	16	NAA 1000 + Thiamine 1000 ppm	24
IAA 6000 + IBA 6000 + Thiamine 6000 ppm	16	NAA 3000 + Thiamine 3000 ppm	24
IBA 1000 ppm	8	NAA 6000 + Thiamine 6000 ppm	8
IBA 3000 ppm	16	NAA 1000 + IAA 1000 + Thiamine 1000 ppm	16
IBA 6000 ppm	32	NAA 3000 + IAA 3000 + Thiamine 3000 ppm	16
IBA 1000 + Thiamine 1000 ppm	0	NAA 6000 + IAA 6000 + Thiamine 6000 ppm	8
IBA 3000 + Thiamine 3000 ppm	16	Control	8

1.2 Collection, characterization, conservation and evaluation of *boradi* (*Ziziphus mauritiana* var. *rotundifolia*) types.

A survey was conducted during February, 1996 in parts of Luni basin spread over Jodhpur, Nagaur, Barmer and Pali districts where groves of *boradi* are available in wild form. Twenty promising types based on their fruit size, quality and freedom from powdery mildew and fruitfly were identified. The plant height varied from 2.5 to 17 m with maximum spread in areas having wet environment in the basin. The colour and density of foliage depends upon the agroecological conditions of the location. In locations having sandy soil and dry climate, the trees show sparse, light green foliage. Diameter at breast height (DBH) also varied with general health of the tree. The fruit shape was generally round, oblong, obovate or round with flat top and sometimes with pointed bottom. The fruit weight varied from 1.4 to 9.0 g and stone weight from 0.5 to 2.0 g. Generally, the trees have not shown symptoms of diseases. Pest infestation was also negligible.

Boradi (*Z. mauritiana* var. *rotundifolia*) seedlings were planted in 6.0 ha area at 6 x 6 m spacing. The survival percentage of these rootstock seedlings was 83.0%. During the survey conducted in Bikaner, Nagaur, Jodhpur, Barmer and Pali districts in February, criteria for selection of disease and pest tolerant *boradi* rootstocks was also taken into consideration.

1.3 Collection, characterization, conservation, evaluation and improvement of cucurbitaceous crops under arid conditions.

Germplasm Collection

In collaboration with NBPGR, Regional Station, Jodhpur, an exploration was made during October, 1995 in the districts of Bikaner, Barmer, Churu, Jaisalmer, Jodhpur and Nagaur.

Mateera (*Citrullus lanatus*)

A total of 38 germplasms were collected. A wide variability for characters such as fruit weight (0.600-3.500 kg), fruit length (12.4-27.5 cm), fruit girth (22.2-62.2 cm), TSS (3.0-8.8 ^{0}Brix), single seed weight (0.050-0.109g) was observed. Fruit samples also exhibited variability in shape (oval, round, oblong, oblong- round or long), rind colour (shades of green having striped rind and green mottled) and flesh colour (white, pink or red). The germplasms were categorised on the basis of seediness, viz., very less seedy (1), less seedy (1), average seedy (19), more seedy (2) and excessively seedy (15).

Kachari

As a result of exhaustive survey in October, 1995, a collection of 183 germplasms was made from arid districts of Rajasthan. The collection included considerable variability with respect to form of plant' foliage colour, leaf size and shape and size, shape, colour and quality of fruits. A wide variability was recorded in fruit shape (oval, round, obovate, oblong or long), size (very small, small, medium or large), weight (3 to 304 g), length (2.2-13.2cm) and girth (6.8-20.5 cm).

Germplasm Evaluation

Mateera

A total of 155 germplasms collected during 1994 were sown in summer 1995 at NRCAH Farm, Bikaner. The crop failed due to adverse weather conditions. During rainy season 1995, these lines were again sown. Evaluation was done with respect to fruit quality, yield and yield attributing traits under rainfed situation. A wide variability was recorded for characters such as vine length (0.94 - 2.16m), number of branches per plant (1.97- 5.64), number of fruits per plant (0.85-3.89), fruit weight (0.350-4.215 kg), fruit length (10.32-27.02 cm), fruit girth (25.96-63.21 cm) and TSS (2.14-8.41 ^{o}Brix). A wide variation was also recorded in fruit shape, rind colour, flesh colour, firmness and seediness. Maximum vine length was noted in AHW 18 (2.96 m) and the minimum (0.94m) in AHW 105. The maximum number of branches per vine was produced in AHW 18 (5.64) and the minimum in AHW 52 (1.7). Number of fruits per plant was maximum in AHW 18 (3.89) followed by AHW 65 (3.54) and AHW 4 (3.47). The maximum weight of fruit was observed in AHW 13 (4.275kg) and minimum in AHW 100 (0.350kg). The maximum length of fruit was recorded in AHW 19 (27.02 cm) while minimum in AHW 49 (10.32cm). The highest fruit girth was recorded in AHW 97 (63.21 cm) and lowest in AHW 22 (26.96 cm). Maximum TSS was recorded in AHW 88 (8.41^{o} Brix) and minimum in AHW 5 (2.14^{o} Brix). These germplasm lines can be utilized in breeding programme (Fig.1).

Kachari (*Cucumis* sp.)

During 1994, 201 germplasms were collected. All the germplasm lines were sown during rainy season 1995 for preliminary

Fig.1 Variability in fruits of mateera

observation and evaluation under rainfed conditions. Randomly selected three plants were used for observations. A wide variability was recorded in growth, flowering and fruiting behaviour, maturity, fruit characters and yield. All the germplasm lines exhibited variability in all the traits. Preliminary evaluation and selections were done to avoid duplicacy. Out of 201 open pollinated collections, about 25 per cent lines were of intermediate type similar to snapmelon (*Cucumis melo* var. *momordica*).

In Kachari, the maximum length of vine was observed in AHK-88 (1.62m) and minimum by AHK-4 (0.59m). Number of fruits per plant was maximum in AHK-159 (22.35) and minimum in AHK-48 (3.44). Fruit weight was maximum in AHK-5 (180.21g) and minimum in AHK-4 (5.34g). Maximum length of fruit was found in AHK-76 (10.67 cm) and minimum in AHK-154 (1.32cm). Maximum girth of fruit was recorded in AHK-5 (21.45cm) and the minimum in AHK-42 (5.23 cm). Maximum TSS was recorded in AHK-18 (7.6 ^{o} Brix) and minimum in AHK-29 (3.4 ^{o} Brix).

Likewise intermediate or snapmelon types showed variability for different characters such as vine length (1.02-1.89 cm), number of fruits per plant (2.00-8.77), fruit weight (60.32-625.14g), fruit length (4.82-19.55cm), fruit girth (12.12-27.53 cm) and TSS (3.0-7.5^{o} Brix).

Fruit shape varied from oval, round, obovate, oblong-round, long to pear or spindle shaped. The fruit size also varied (very small, small, medium or large). All the lines showed generally light green, green, light orange, pale yellow or whitish yellow colour and striped or mottle fruit skin colour. Flesh colour of the fruit was whitish green, whitish, whitish yellow, light orange, yellowish orange or their shades. These germplasm lines could be useful in breeding programme (Fig.2).

Fig.2 Variability in fruits of *Kachari*

Snapmelon (*Cucumis melo* var. *momordica*)

Eighty five germplasm lines collected during 1994 were sown in rainy season 1995 at the NRCAH Farm. Evaluation was done for fruit quality, yield and yield attributing traits under rainfed situations. Randomly selected three plants were used to record observations. Variability was observed in characters like growth, flowering and fruiting behaviour, maturity, yield and fruit quality. Maximum vine length was recorded in AHS-50 (2.10m) and minimum in AHS-29 (0.82m). Number of fruits per plant was maximum in AHS-57 (5.0) and minimum in AHS-28 (1.2). Fruit weight was maximum in AHS-9 (1.250kg) and minimum (0.055kg) in AHS-23. Maximum length of fruit was measured in AHS-9 (24.9 cm) and minimum in AHS-23 (3.2 cm). The fruit girth was maximum in AHS- 27 (35.4 cm) and minimum in AHS-23 (14.4 cm). Maximum TSS value was recorded in AHS-79 (7.4° Brix) and minimum in AHS-58 (2.8° Brix). A wide variability was also recorded in fruit shape, skin colour, flesh colour and texture, fruit cavity and seed content which may be useful in breeding programme (Fig.3).

Fig.3 Variability in fruits of Snapmelon

Germplasm Improvement

Watermelon type Mateera

All the open pollinated germplasm lines (155) as grown for evaluation during summer, 1995 were selfed. A total of 450 female flowers were selfed in these lines. Out of them only 31 lines yielded selfed fruits as a result of crop failure and poor fruit setting.

During rainy season of 1995, the 155 germplasm lines were again sown for selfing alongwith the 31 progeny rows of first selfed generation. Out of 155 base germplasm lines, 134 selfed fruits were selected from 98 genotypes while 56 selfed fruits selected from 31 progeny lines of first selfed generation on the basis of fruit characteristics, quality and yield performance. The above selfed generation lines are being utilized in improvement programme.

1.4 Performance of clusterbean varieties under arid rainfed situation

Clusterbean (*Cyamopsis tetragonoloba* L. Taub) commonly known as *guar*, mainly grown rainfed for grain production in the arid region, is a drought resistant legume. Its pods are consumed as vegetable. The pods are rich in calcium, phosphorus, iron and vitamin A and C. In order to identify a suitable vegetable type clusterbean, an experiment was conducted.

The treatments comprised twelve varieties/lines of clusterbean, collected from NBPGR, New Delhi (7), HAU, Hisar (2) and one each from GAU, S.K. Nagar and CHES, Godhra, Gujarat besides local collections of Bikaner. The experiment was conducted in RBD with three replications. Observations regarding the various parameters of vegetative growth and yield were recorded.

Maximum plant height was observed in local collection (88.57 and 91.47cm) and minimum in CHES - 1.1 (22.81 and 32.39 cm) at 60 and 90 days after sowing (DAS), respectively. The cultivar Sharadbahar produced maximum number of branches (8.51) per plant in comparison to a minimum 0.45 in PLG-85. Days taken to 50 per cent flowering was minimum in Sharadbahar (42.64 DAS) while HG-75 takes 52.46 DAS. The maximum number of pods/cluster was recorded in the local collection (7.37) whereas, the minimum in CHES-1.1 (2.85). The number of clusters per plant was also found to be highest in local (14.513) followed by Sharadbahar (9.623) and the minimum in CHES-1.1 (4.896). Maximum length of pod was observed in Pusa Navbahar (8.54 cm) followed by Sharadbahar (8.27 cm) and the minimum in Suvidha (4.53 cm). Single pod weight was the highest in Pusa Navbahar (1.805 g) and the lowest in HG-75 (0.634 g). Maximum green pod yield per plant was recorded in local (71.60 g) followed by Pusa Navbahar (48.16g) and minimum (17.36g) in Gujarat Guar-1.

1.5 Collection, conservation and evaluation of pomegranate cultivars under hot arid environment.

Pomegranate cultivars Jalore Seedless, Ganesh, G 137, Bassein Seedless, GKVK 1, Dholka, Jodhpur Red, Khog, P 23, P 26 and Mridula were collected. Table 4 shows the extent of survival. Vigorous growth was noticed in Mridula and P 23.

Table 3 : Performance of clusterbean varieties/lines under arid rainfed condition.

Germplasm	Plant height 60 DAS (cm)	Plant height 90 DAS (cm)	No. of branches /plant	Days taken to 50% flowe-ring (DAS)	No. of pods/ cluster	No. of cluster /plant	Pod length (cm)	Single pod weigh t (g)	Green pod yield/ plant (g)	Pod quality	Internodal length (cm)	Bearing from base (true leaf)	Leaf size (cm)
Pusa Navbahar	43.43	55.26	2.136	45.22	5.156	8.366	8.540	1.805	48.163	Excellent	3.45	2.88	4.30 X 3.13
Sharadbahar	51.70	65.42	8.516	42.64	4.536	9.623	8.270	0.925	44.410	Good	4.00	3.55	4.66 X 2.63
Sona	52.66	64.78	4.200	51.44	5.506	9.423	6.543	0.732	27.196	Poor	3.73	4.88	4.06 X 2.70
Suvidha	40.46	53.25	6.310	53.93	3.570	9.433	4.533	0.942	24.433	Poor	2.93	3.77	2.80 X 1.93
Naveen	47.56	59.43	5.823	50.23	4.420	7.523	6.363	0.971	38.370	Poor	2.16	2.66	4.06 X 2.46
PLG-85	50.09	73.84	0.450	50.72	3.823	8.556	5.416	0.815	21.376	Poor	2.96	2.66	4.76 X 3.46
9229/P3	51.16	67.30	3.230	48.46	5.373	8.316	5.186	0.907	31.513	Poor	2.63	4.88	3.93 X 2.33
Gujarat Guar-1	57.78	67.47	3.526	48.65	3.310	7.626	6.136	0.717	17.363	Poor	2.60	4.22	4.43 X 2.60
HG-365	49.79	62.89	5.473	46.22	3.816	6.256	6.023	0.865	18.290	Poor	3.10	4.88	3.80 X 2.73
HG-75	44.94	62.52	5.283	52.46	4.376	9.573	5.173	0.634	26.526	Poor	3.26	4.88	3.93 X 2.50
CHES-1-1	26.81	32.39	1.616	49.60	2.833	4.896	5.663	0.767	19.013	Good	2.56	2.88	4.23 X 2.56
Local collection	88.67	91.47	1.813	44.66	7.37	14.523	5.926	0.818	71.600	Poor	3.23	3.11	5.20 X 3.36

Table 4. Performance of pomegranate varieties

Varieties	% Survival (March, 1996)
Jalore Seedless	55.0
Ganesh	100.0
G 137	87.5
Bassein Seedless	81.2
GKVK 1	47.4
Dholka	90.0
Jodhpur Red	58.3
Khog	100.0
P 23	100.0
P 26	100.0
Mridula	100.0

1.6 Collection, conservation and evaluation of prickly pear (*Opuntia ficus-indica*) in hot arid conditions.

Out of 43 types, 39 exotic and 4 local types of cactus pear were collected from NARI, Phaltan and arid parts of Rajasthan. Cladodes were planted during September, 1995 along with a set in earthen pots in field to observe their performance. Cladodes were treated with Bavistin solution (2g/lit.) before transplanting. Survival of cladodes was cent per cent. Vigorous growth and sprouting in cladodes was observed under field condition than in pots.

Farm Development

Demarcation of plots, blocks, path and roads was made and 20 ha area was demarcated to develop hectare size plots.

Along 8 km length of fencing, 8-10m wide land strip was levelled to develop a shelter belt plantation. Saplings of neem (1516) and *khejri* (484) were planted in July 1995 at 3.0 running metre along the fencing. Upto November, 1995 and March 1996, the survival percentage was about 80 and 45, respectively.

Ornamental and fruit plants were raised under polynet shade nursery for plantation at campus and for field experiments.

Library

Efforts were made to collect reference books, journals, periodicals and relevant documents related to horticulture and allied disciplines. During 1995-96, total 186 books were procured while 2 International and 14 Indian journals and periodicals were subscribed. The library also subscribes "CAPS CONTENTS" of 30 International and National journals from INSDOC, New Delhi.

Other Activities

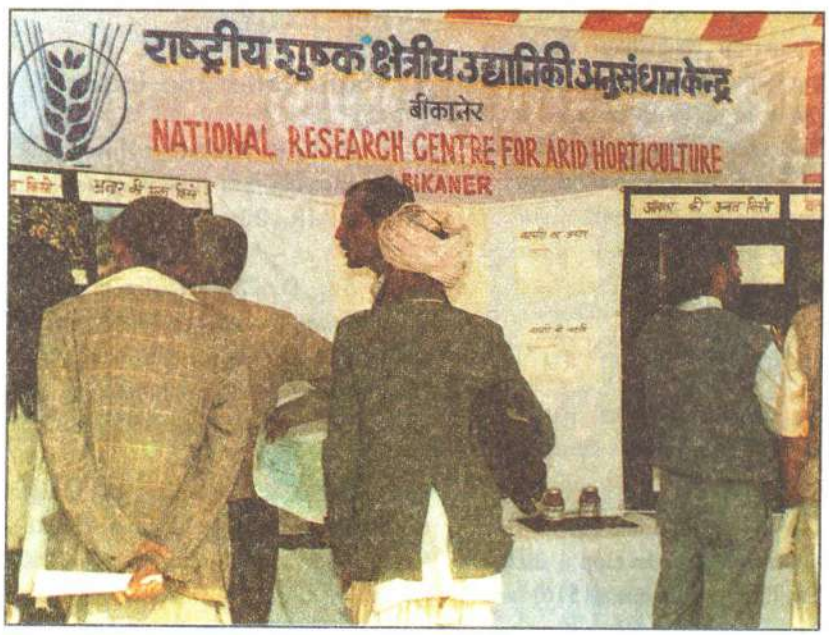
A. Radio talks and lectures

Sh. D.K. Samadia : How to get maximum profit through seasonal vegetable production (Hindi), AIR, Bikaner on 17.5.95.

Sh. D.K. Samadia : Cultivation of cucurbitaceous crops (Hindi) training organised by Hunger Project, Department of Horticulture and Agriculture, Government of Rajasthan at KVK, Bikaner on 26.5.1995.

Sh. D.K. Samadia : Use of plant growth regulators in plant propagation (Hindi). Training for nursery management at KVK, Bikaner 6.9.95.

Dr. K.L. Chadha, DDG (H), ICAR, New Delhi visited NRCAH Farm



Centre participated in Kisan Mela at Abusar (Jhunjhunu)

Sh. R.S. Singh : "Arid Fruit Production" in National integration camp of Senior Division Boys of the Country organised by 7th BN. NCC, Rajasthan held at Bikaner on 14.10.1995.

Dr. Vishal Nath : Phaslon Men Sinchai Ki Nai Viksit Paddhati- Favwara Evam Drip Sinchai, AIR, Bikaner on 13.5.95.

Dr. Vishal Nath : Alankrit Paodhon Ko Paudhshala Mein Taiyar Karna. Training programme of Horticulture Suprintendent at KVK, Bikaner on 8.9.95.

B. Participation in Kisan Melas

NRCAH participated in Krishi Vigyan Mela and put a stall of the Centre in exhibition at Krishi Vigyan Kendra, Abusar, Jhunjhunu on 23.12.1995.

Organized an exhibition on Arid Zone Fruits during Group Workers Meeting of All India Coordinated Research Project on Arid Zone Fruits at RAU, Bikaner on 5.1.96.

NRCAH participated in Kisan Mela and put a stall in exhibition/Mela organized by KVK, Bikaner at Sherera village, Bikaner on 28.2.1996.

C. Human Resources Development

Dr. Vishal Nath, Scientist (H) has attended a training course of "Collection, conservation and evaluation of minor tropical fruit germplasm" during 26.2.96 to 9.3.96 at NBPGR, New Delhi.

Dr. B.D. Sharma, Scientist (SS) has attended a short course on "Use of computer in Agricultural Research" held at IASRI, New Delhi during 17.9.96 to 30.9.96.

Dr. B.D. Sharma, Sci (ss) has attended training on "Computer networking and data communication" organised by ICAR, New Delhi during 5.12.96 to 11.12.96.

Sh. M.K. Jain, Sr. Computer (T-II-3) attended computer training course organised by NAARP at IASRI, New Delhi during 20.11.95 to 6.12.96 and attended E-mail training course organised by ICAR, New Delhi during 25.12.95 to 30.12.95.

Publications

a. Research paper/book review/ bulletines/books

1. Pundir, J.P.S.; Pareek, O.P. and Verma, Inder Mohan (1995). Pashchimi Rajasthan Ke Deshi Phal. Phal-Phool, December 1995, pp 36-39.
2. Pareek, O.P. and Sharma, Suneel (1995). Under exploited fruits for adverse ecological conditions. In : Impact of Modern Agriculture on environment, ed. Arora, Behl and Tawo, CCS HAU, Hisar and Max Muiller Bhawan, New Delhi, pp 11-20.
3. Pareek, O.P. and Vishal Nath (1996). Potential of Horticultural Production in arid region. In: Changing contours of Arid Ecology, Vol. II. Asian Environmental Council, Jaipur, Eds. Prof. Indra Pal : In press.
4. Pareek, O.P. and Singh, R.S. (1995). Shushka Kshetra Main Ber Se Adhik Amadni, NRCAH Ext. Bull. No. 1, pp 1-8.
5. Pareek O.P. and Chandra, Atul (1995). Date palm cultivation in India. Farm Unit,

Directorate of Extension, Ministry of Agriculture. Govt. of India, New Delhi, pp 1-22.

6. Pareek O.P. and Chandra, Atul (1995). Shushka Kshetra Men Khajoor Ki Kheti, Directorate of Extension, Ministry of Agriculture, Govt. of India, New Delhi, pp 1-23.
7. Pareek, O.P. (1995). Ber (Hindi) ICAR, New Delhi, pp 1-180.

B. Reports

1. Biennial Report. AICRP on Arid Zone Fruits, 1994-95, pp 1-348.
2. Annual Report AICRP on Arid Zone Fruits, 1994-95, pp 1-103.
3. Annual Report NRC for Arid Horticulture, 1994-95, pp 1-12.

C. Proceedings

1. Proceedings of VIII Research Workers Group Meeting of AICRP on AZF held at RAU, Bikaner during 4-6 January, 1996.

Visitors

1. Dr. K.L. Chadha, Deputy Director General (Horticulture), ICAR, New Delhi.
2. Dr. S.P. Ghosh, Asstt. Director General (Horticulture), ICAR, New Delhi.
3. Dr. I.S. Yadav, Director, Indian Institute of Horticulture Research, Bangalore.
4. Dr. B.S. Chundawat, Principal, Aspee College of Forestry and Horticulture, Navsari, Gujarat.
5. Dr. M.S. Manohar, Director of Research, Rajasthan Agricultural University, Bikaner.
6. Dr. A.K. Gupta, Zonal Coordinator (VI Zone), CAZRI campus, Jodhpur (Rajasthan).
7. Er. G.S. Kadapatti, Director, Kuslagi Tq. Horticultural growers Society, Hungurd, Distt. Bijapur (Karnataka).
8. Er. A.K. Gupta, Director Works (Incharge), ICAR, New Delhi.
9. Dr. D.C. Bhandari, Officer Incharge NBPGR, Regional office (CAZRI campus), Jodhpur.
10. Dr. P.N. Gupta, Head, Germplasm Evaluation Division, NBPGR, New Delhi.
11. Sh. U.G. Desai, Chief General Manager, NABARD, Jaipur.
12. Dr. B.D. Kalla, Ex-Minister of Rajasthan, Bikaner (Rajasthan).
13. Sh. Yaspal Singh, 31, Shyam Nagar, Pilokar Road, Meerut City (U.P.).
14. Director of Horticulture, Govt. of Rajasthan, Pant Krishi Bhavan, Jaipur.
15. Director Horticulture, Govt. of Haryana, SCO-3013-14, Sector-22, Chandigarh.
16. Dr. G.B. Raturi, Head, CHES, Godhra (Gujarat).
17. Dr. B.B. Vashishtha, Sr. Scientist (Hort.), CAZRI, Jodhpur.
18. Sh. G.R. Bhansali, Finance & Account Officer, CAZRI, Jodhpur.

Awards

Dr. O.P. Pareek, Director, NRCAH was awarded by Indian Society of Health, Environment, Education and Research (ISHEER), Bikaner for his work in the field of Agricultural Sciences for the year 1994-95.

Finance

The total approved outlay for the VIII Plan period and budget estimates and expenditure incurred during 1995-96 are given in Table 5 and 6.

Table 5 : VIII Plan Outlay for NRCAH, Bikaner

Head	Rs. (in Lakh)
1. Recurring contingency	
a) Pay and allowances	35.00
b) T.A.	2.50
c) Contingencies	15.00
Total (A)	52.50
2. Non recurring contingency	
a) Equipments	36.50
b) Works	248.00
c) Library	6.00
d) Vehicle	7.00
Total (B)	**297.50**
Grand Total (A+B)	**350.00**

Table 6: Budget estimate (BE), revised estimates (RE) and expenditure incurred during 1995-96 (Rs. in Lakhs)

Head	BE	RE	Expenditure
Pay and allowance	6.60	6.60	6.57
T.A.	0.40	0.40	0.26
Other Charge including Equipments	16.00	20.00	24.82*
Works	64.00	64.00	59.17
Total	87.00	91.00	90.82

* Rs. 4.83 Lakh reappropriated from the head "Works"

Staff (as on 31.03.96)

(a) Scientific

Dr. O.P. Pareek	Director
Dr. B.D. Sharma	Scientist (Sr. Scale) Soil
Sh. R.S. Singh	Scientist (Sr. Scale) Hort.
Dr. Vishal Nath	Scientist Hort.
Sh. D.K. Samadia	Scientist Hort.

(b) Administration

Sh. R.P. Singh	Asstt. Adm. Officer
Sh. Ayaz Ahmed	Asstt. Fin. Acc. Officer (on Deputation)
Sh. V.K. Pandey	Assistant
Sh. Rajesh Daiya	Jr. Clerk
Sh. Kuldeep Pandey	Jr. Clerk

(c) Technical

Sh. M.K. Jain	Sr. Computer T-II-3
Sh. Bhoj Raj Khatri	Computer T-1
Sh. Vinod Kumar	Field Technician T-1
Sh. R. K. Pratap	Lab. Technician T-1
Sh. P.R. Singh	Field Technician T-1

(d) Auxiliary

Sh. P.P. Pareek	Hindi Translator
Sh. Satpal	Jypsy Driver
Sh. Ashok Kumar	Tractor Driver

(e) Supporting

Sh. Shiv Dayal	SSG-I
Sh. Ghanshyam	SSG-I

APPENDIX-I

All India Coordinated Research Project on Arid Zone Fruit has 12 centres. The project's objective is to develop fruit growing technology for the arid regions of the country with particular reference to fruit such as ber, date palm, pomegranate, fig, custard apple, aonla and bael with a view to build up a viable commercial cultivation of fruit crops in the arid regions and thus improve the economic condition of the people , their nutrition and health standard.

Centre	Crops	Major results
Anantapur	Ber, custard apple, fig, pomegranate, aonla	Pomegranate cv. Ganesh produced highest yield; 5% catchment slope gave better performance.
Aruppukottai	Ber, custard apple, aonla, and pomegranate	Promising types of ber, wood apple identified; cultivar Kaithali produced maximum fruit yield; carbendazim 0.1% proved effective in controlling black leaf spot of ber.
Banglore	Ber, pomegranate, fig, custard apple	Fig cultivar Excel produced maximum fruit yield on Brown Turkey rootstock; promising pomegranate hybrids have been identified; Arka Sahan, a hybrid custard apple has been developed.
Bawal	Ber, aonla, pomegranate	Fruitfly resistant ber types were identified; carbandazim 0.1% proved effective in controlling black leaf spot of ber; 4 sprays of 0.2% chlorothalonil at 15 days interval was effective to control fig rust.

Faizabad	Aonla, ber, bael	Pinkish red aonla types identified; NA 6 proved to be best pollinizer for NA 7.
Jobner	Ber, aonla, pomegranate	Gola gave the highest yield; for control of fruitfly, first 2 sprays with monocrotophos 0.03% and 3rd spray with seveinflo (carbaryl) 0.1% at 15 days interval starting from pea stage have been found most effective; 4 sprays of 0.2% chlorothalonil at 15 days interval was effective to control aonla rust at Chomu.
Mundra	Date palm	Red coloured date palm identified.
Rahuri	Pomegranate, ber, custard apple	Pomegranate selection No. 429 gave best yield; 30% wetted area at alternate days proved better for pomegrante; 0.3% wettable sulphur once after pruning and twice at one month interval followed by 8 sprays at 10 days interval were most effective.
Sardarkrushinagar	Ber, pomegranate, aonla	3 Sprays, respectively, with monocrotophos 0.01%, fenthion 0.05% and carbaryl 0.1% at 15 days interval were found effective to control fruitfly Methyl eugenal was found to be effective to trap some species of fruitfly.

APPENDIX-II

Sanctioned staff strength as on 31.3.1996.

Cadre	Strength	Filled	Vacant
Scientific	21	05	16
Administration	12	05	07
Technical	09	05	04
Auxillary	03	03	Nil
Supporting	10	02	08
Total	55	20	35

ACKNOWLEDGEMENT

Thanks to all the staff of the NRCAH for successful conduct of different activities.

सारांश

केन्द्र द्वारा किए गए विकास एवं अनुसंधान सम्बन्धित कार्यों का संक्षिप्त विवरण:—

खेजड़ी (प्रोसोपिस सिनेरारिया)

एक व्यापक सर्वे द्वारा राजस्थान के 11 जिलों से एकत्रित खेजड़ी के जनन द्रव्यों में पत्तियों, टहनियों, छालों आदि के आकार, प्रकार एवं रंग तथा फलियों (सांगरी) की परिपक्वता व बीजों की संख्या में विभिन्नता पाई गयी। बीकानेर क्षेत्र के आस-पास किए गए व्यापक सर्वेक्षण में खेजड़ी के तीस जननद्रव्यों को अंकित किया गया जिनकी फलियाँ सब्जी के लिये उपयुक्त पाई गयी। इसके साथ ही राष्ट्रीय पादप आनुवांशिकी अनुसंधान ब्यूरो, जोधपुर से प्राप्त 171 जननद्रव्यों पर भी अनुसंधान कार्य प्रगति पर है। खेजड़ी में पौध प्रसरण कार्य भी प्रारम्भ किया गया है जिसमें 3-6 हजार पी. पी. एम. आई. ए. ए., आई. बी. ए. तथा एन. ए. ए. का प्रभाव अच्छा पाया गया है।

बोरडी (बेर) ('जिजिफस मौरिटिएना' प्रजाति, 'रोटूडींफोलियो' प्रकार)

लूनी नदी के कछार में किए गए सर्वेक्षण बोरडी के 20 विभिन्न जननद्रव्यों का चयन किया गया है जिनमें बड़े व मीठे फल तथा कीट-व्याधि के लक्षण गौण पाये गये। वर्ष 1995 के जुलाई माह में प्रक्षेत्र में छः हैक्टर क्षेत्र में इसके मूलवृन्द रोपण कार्य भी किया गया।

मतीरा (स्ट्रिलस लेनेटस)

फलों का भार, लम्बाई-मोटाई, मीठापन आदि के आधार पर मतीरे के 38 जनन द्रव्यों का चयन किया गया। गत वर्ष के 155 जननद्रव्यों को इस वर्ष वर्षाऋतु में प्रयोग के आधार पर खेत में लगाया गया। इनमें से कुछ जननद्रव्य शुष्क क्षेत्र के लिये उपयुक्त पाये गये।

काचरी (कूकूमस स्पेशीज)

पौधों की बढ़वार, फलों तथा पत्तियों के रंग, आकार-प्रकार और गुणवत्ता के मापदण्डों को लेकर वर्ष मध्य में राजस्थान के विभिन्न मरूस्थलीय जिलों में सर्वेक्षण कर काचरी के 183 जननद्रव्यों का संग्रह किया गया। गत वर्ष एकत्रित जननद्रव्यों को वर्षा ऋतु में खेत में प्रयोगार्थ लगाकर उपयुक्त जननद्रव्यों का चयन किया गया जो भविष्य में पादप प्रजनन हेतु प्रयोग किये जा सकेंगे।

काकड़ी (स्नेप मेलन)

फल की गुणवत्ता एवं उपज हेतु गत वर्ष एकत्रित किए गये 85 जननद्रव्यों को वर्षाऋतु में खेत में लगाया गया। उपज, फल की गुणवत्ता, वृद्धि एवं फलने-फूलने की प्रकृति के आधार पर कुछ जननद्रव्यों को उपयोगी पाया गया है जिन्हें फसल सुधार हेतु प्रयोग किया जा सकेगा।

इन सबों के अतिरिक्त वर्ष के दौरान अन्य कई फल व सब्जी फसलों के जननद्रव्यों का भी एकत्रिकरण किया गया, इनमें अनार (II) नागफनी (कैक्टस पीअर) (43) प्रमुख है।

प्रक्षेत्र विकास

केन्द्र के फार्म क्षेत्र में मुख्य प्रयोग प्रक्षेत्र की परिधि में नीम, खेजड़ी इत्यादि वृक्षों की पौधरोपण का कार्य किया गया साथ ही 20 हैक्टर क्षेत्र को विभिन्न खण्डों में विभाजित कर सड़क एवं मार्गों का निर्धारण कर अंकित करने का कार्य भी सम्पन्न किया।

अन्य गतिविधियों में पुस्तकालय का विकास, वैज्ञानिकों द्वारा किसान मेलों व अन्य अवसरों में भाग लेकर किसानों को उपयोगी सूचनाएं तथा लेखन सामग्री उपलब्ध करवाई गयी। मानव संसाधन विकास कार्यक्रम के अन्तर्गत केन्द्र ने विभिन्न प्रशिक्षण कार्यक्रमों में भी भाग लिया।