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DESERT ENVIRONMENT NEWSLETTER

ENVIS Centre on Combating Desertification
ICAR-CAZRI

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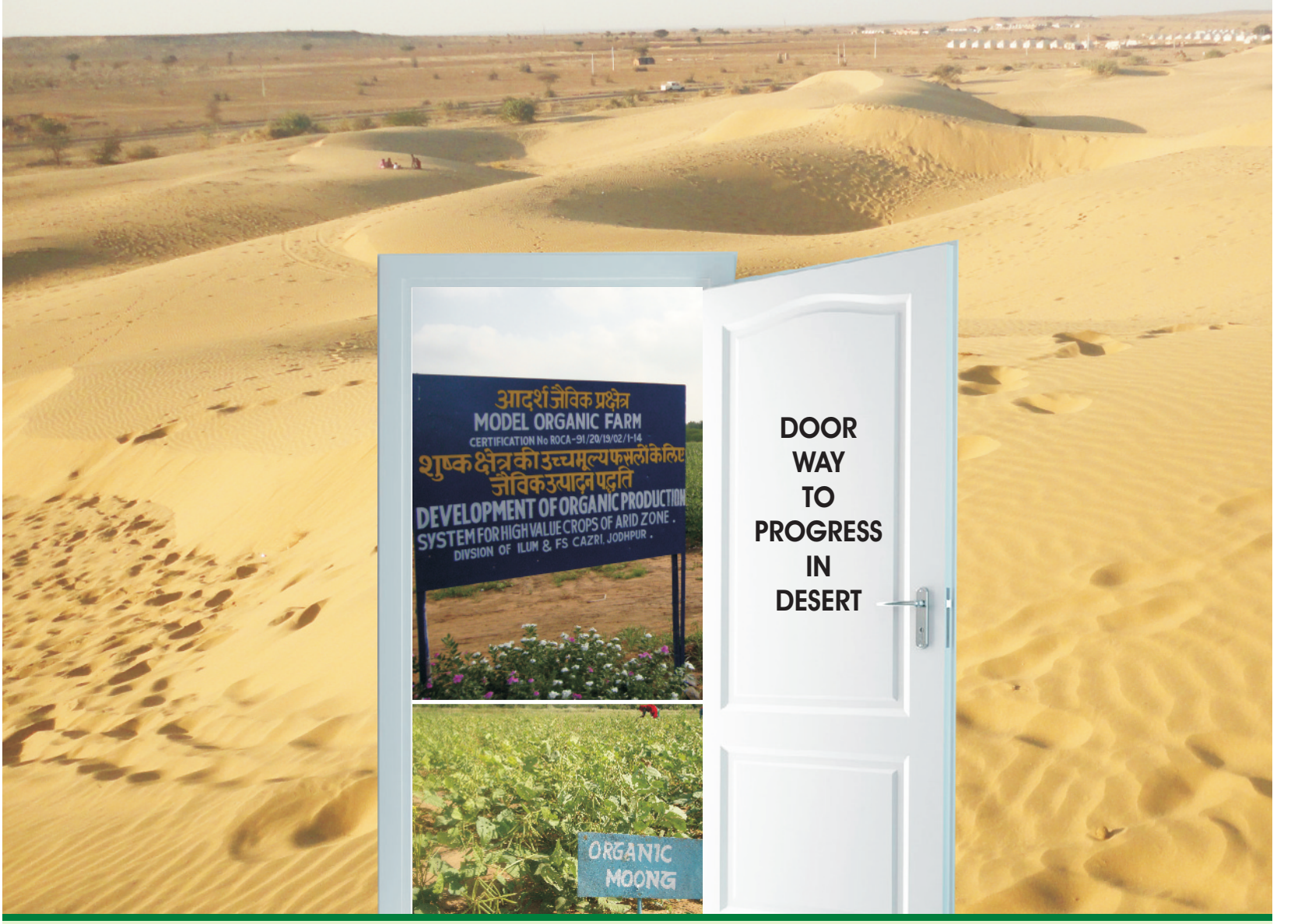

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From the desk of chairman

Arid zones around the world are full of peculiarities often stretching beyond our imaginations. We often imagine arid regions having lofty sand dunes, with little or no vegetation and absolute scarcity of water. But we seldom look below our feet while walking on sand in the desert where exists a huge array of blue green algae, mosses and lichens, together known as biological soil crusts (BSCs). These BSCs are the earliest pioneers stabilizing barren surface. This issue highlights this aspect of desert landscapes. Details of wild jujube, an endemic to the Indian desert and having truncate leaves make interesting reading.

"Go Organic with Harvested Rainwater" in our technology section proves the worth of organic farming in dry lands. A feature on 'National Research Centre on Camel' would hopefully interest you with wholesome knowledge on camel research. ENVIS team has given gist of water policy in the most lucid way. ENVIS CAZRI put up an impressive demo stall in the Ashoka Hotel , New Delhi which was appreciated by one and all, especially Sh. Prakash Javdekar , Hon'ble Minister of State for Environment, Forest & Climate Change (Independent Charge) Govt. of India. All these and many more information make this issue a very interesting compendium of useful knowledge.

Have an enjoyable reading !

(O.P. Yadav)

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Know Your Desert

Desert Plant Diversity: Life under your feet (Biological Soil Crusts)

In arid and semi-arid regions throughout the world, vegetation cover is often sparse and only open spaces below canopy are usually covered by highly specialized community of cyanobacteria, mosses, and lichens termed as Biological soil crusts (BSCs).

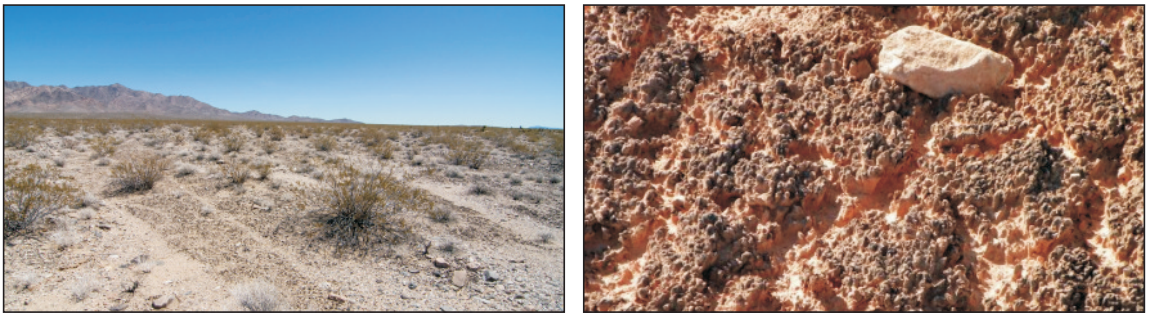
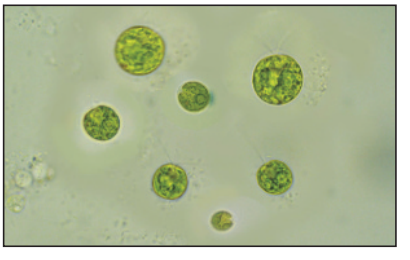


Figure 1: (a) Biological Soil Crust-A View (b) A Closer Look towards BSCs

Crusts are predominantly composed of cyanobacteria (formerly called blue-green algae), green and brown algae, mosses and lichens. Liverworts, fungi and bacteria are also present. In hot deserts, such as the Sonoran and others, the cyanobacteria are more common. Some more acidic soils are dominated by green algae. Shifts between green algal and cyanobacterial dominance have been attributed to changes in pH, with the decreasing alkalinity favoring green algae. More stable crusts are dominated by lichens and/or mosses. The organism that dominates the crust is partly determined by microclimate and may also represent different successional stages in crust development (Fig. 1a & 1b). The various morphological groups for biological soil crust components with examples of common taxa or groups are depicted below (Fig. 2). Indian part of Thar Desert also has presence of BSCs.

Cyanobacteria (*Microcoleus vaginatus*)



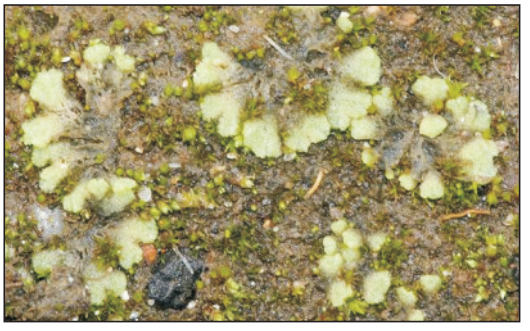
Coccoids algae

Short moss (*Bryum spp.*)

Short moss (*Bryum* spp.)

Ceratodon purpureus

Tall moss (*Tortula ruralis*)



Liverwort (*Riccia spp.*)

Crustose lichens (*Lecanora muralis*)

Gelatinous lichens (*Collema cocophorum*)

Squamulose lichen (*Psora decipiens*)

Foliose lichen (*Peltigera occidentalis*)

Fruticose lichen (*Aspicilia hispida*)

Fig. 2 Different Biological Soil Crust Components

Roles in ecosystem functions

Crusts play an important role in the environment. Because they are concentrated in the top 1 to 4 mm of soil, they primarily affect processes that occur at soil-air interface. These include soil stability and erosion, atmospheric nitrogen-fixation, nutrient contributions to plants, soil-plant-water relations, infiltration, seedling germination and plant growth.

Envisaging researches on BSCs in Indian Desert

Understanding the species composition and general distribution of soil crusts in different habitats is of utmost importance in their role in carbon fixation in order to quantify their ecosystem services. Concerted and coordinated efforts among different scientific sub-disciplines will hopefully show the way forward.

Dipankar Saha and C. B. Pandey
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Know Your Desert Plants

Ziziphus truncata Blatt. &Hallb **(Rhamnaceae)**

Fig. 3 Habit of *Z. truncata*

Ziziphus truncata Blatt.&Hallb., locally known as Boti, belongs to family Rhamnaceae. It occurs naturally on sandy plains. Its common associates are *Calotropis procera* and *Capparis decidua.* It is an endemic plant of Indian desert.

It is a small shrub with divaricate, chesnut-coloured, downy branches (Fig. 3). Two stipular prickles are tomentose at base but other-wise glabrous and are up to 1 cm long though one is shorter and straight, other longer and recurved. Leaves are alternate, petiolate, coriaceous, orbiculate, somewhat longer than broad, up to 3.5 cm long, serrulate, subcordate at base, truncate at apex (Fig. 4). Truncate portion can have a length of 10 mm with irregular dentation. Leaves are glabrous except petioles and margin. Veins and veinlets on the lower surface are 3-nerved from base; nerves extending right up to apex; midrib with 2-3, equal secondary veins; other 2 veins surrounded by side veins; on exterior. Petiole is up to 5 mm long. Flowers are in cymes which are short, axillary, sessile and tomentose. Buds are hemispherical, tomentose with their pedicels up to 4 mm long. Calyx is 5-fid; lobes laterally triangular and opened out, carinate near apex. Petals are spathuate, rounded at apex. Disc is 10-lobed, with 10-furrows; Styles are two, connate, divergent near apex. Fruit is a drupe globose, 6-8 mm in diam., glabrous, yellow when ripe (Fig. 5). It's flowering and fruiting occurs during October to November.

Though it is endemic to Indian desert,it is not so niche specific as it is distributed on sandy plains and hummocks impeded below with kankar pan or hard rock in western Rajasthan. It occurs on a variety of land uses from wastelands to grazing lands, crop fences and around habitations. The trunk and its branches are used as fuel by local people. Its leaves and fruits are used as fodder for cattle.It is restricted in distribution and has species-specific edaphic/climatic requirements. Modification and destruction of the habitats due to urbanization resulted in fragmentation of its populations which ultimately perished.Use of its leaves and fruit as fodder is much in the same way as *Ziziphus nummularia* (Jharbor). Hence in the guise of *Z. nummularia*, in fact *Z. truncata* is also cut and harvested from wastelands. Farmers unknowingly remove it as weed from fallows and croplands. Its extensive exploitation for commercial purpose has also made it rarer. Now it stands threatened because its spread has greatly reduced and populations have become thin and sparse. Efforts to regenerate it have been successful for its ex-situ conservation at CAZRI, Jodhpur.

Fig. 4 Truncate leaves

Fig. 5 Fruits of *Z. truncata*

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Technological options

Organic farming with harvested rainwater: The Income insurance of small farmers

Low rainfall areas (rainfall below 500 mm/yr) of the country cover about 45 million ha area mainly in Rajasthan (12 districts) and a small part in Gujarat, Andhra Pradesh and Tamil Nadu. Even this low rainfall is uncertain, uneven and erratic coupled with frequent droughts. To cope with such aberrant weather, people have since long evolved and following a multi-component farming systems of annuals, perennials and livestock. These systems based on recycling of local resources were by default organic and minimize the risk of aberrant weather. Though these systems have sustained production under prevailing climatic uncertainties, their productivity is very low due to inefficient use of local resources specially the water. Governments efforts through National Horticulture Mission for providing farm ponds benefits farmers having a minimum of 3 ha land; thus small farmers are left out. Additionally farm pond is filled with water taken out from Tube wells, thus no provisioning of surface water harvesting has made the whole system unsustainable. Hence, a self-sustained model was developed for small farmers.

Possibilities of rainwater harvesting and efficient utilization were explored through experimentation in model organic farm (2.0 ha) established in 2008, within the Central Research Farm CAZRI, Jodhpur. Bunding all around the farm is done for in situ rainwater conservation and to avoid chemical contamination with the drift of rainwater from outside fields. The farm was registered for certification and got status of "Certified Organic Farm" in the year 2011 in which production system model has emerged as viable for providing livelihood and nutritional security to the small farmers in rain fed arid land (Fig. 6).

In this system rainwater harvesting tank of 6000 liters capacity with catchment area of 50 m^2 has been constructed (Fig. 7). Cost of construction is around Rs. 14,000, if the family labour is engaged. This tank can be filled with rainfall of 170 mm. The tank is covered with RCC roof and two 1000 liters HDPE interconnected overhead water tanks mounted on it. The harvested rainwater is manually lifted with small hand pump to these water tanks that will allow to move through drip system with gravity flow. By this way no solar device is required.

Now this rain water has been used for irrigating 30 ber plants, in 0.1 ha area (1000m^2) through passive drip system, if the dry spell remains for more than 15 days. In the inter row spaces of ber plants, moong bean (Fig. 8 & 9) and snap melon are grown. Mulching is done with agrowaste/weeds to avoid loss of water. There are four naturally grown Khejri (*Prosopis cineraria*) trees that provide pods (used as vegetable), leaves (fodder) and fuel wood. If the rainfall remains normal in a year then this harvested water can be used for cumin (a high value, low water requiring crop) cultivation in winter. Therefore, all possible uses of precious rainwater is ensured in the system.

Ber (*Ziziphus mauritiana*) is a native multipurpose tree of this region that not only provides fruit but also leaf fodder and fuel wood from annual pruning (fruits come on new branches).

Income from this system with very conservative estimates is as follows:

1. Ber fruit = 900 kg (30 kg/plant) @ Rs. 20/kg = Rs. 18,000/-
2. Ber dry leaves = 90 kg @ Rs. 4/kg = Rs. 360/-
3. Fuel wood = 150 kg @ Rs. 5 kg = Rs .750/-
4. Moong bean/ guar + snap melon or cumin = Rs. 5,000/-
5. Produce of Kejri trees = Rs. 1,500/-
6. Total = Rs. 25,610/-

Fig. 6 A view of model organic farm at CAZRI, Jodhpur

If the labor cost of this whole system is 60% (Rs. 15,366) then a net profit of Rs. 10,244/- can be earned from 0.1 ha area with this system in one year. Practically this labor cost is also taken care by the family members and this can also be indirectly added in the income of the farm family. Since this is under organic management, all farm waste is being recycled and utilized as manure and biopesticides. Therefore, no expenditure is done on external inputs. With the addition of organic manure every year, both the water holding capacity and nutrient availability in soil is increased. Growing of well adapted local crop further enhances water use.

Fig. 7 Rain water harvesting tank at the Model organic farm.

If the same model is replicated in one ha area, income can be Rs. 1,02,440/- p.a. or around Rs. 8,540/- per month of a farm family. The advantage of this system is that no electricity, no ground water and no chemical is utilized, ensuring long term sustainability of system that too under highly variable rainfall conditions of arid land. Providing nutrition security to the farm family is the added benefit of this model.

Farmers Adoption

Several hundreds of farmers visit this farm every year and have adopted this concept in last three years. They modified it according to their resource availability and managerial capacity. Some are growing different fruits (ber, pomegranate, lime, aonla etc.) and vegetables (snap melon, chilli, brinjal, tomato etc.) as per their family needs while others are growing only one fruits species and grain crop.

Fig. 8 Organic 'Ber' at Model Organic Farm

Fig. 9 Organic Moong at the Model organic farm

Arun. K. Sharma
ICAR-CAZRI, Jodhpur

Know Your Institutions

ICAR-National Research Centre on Camel, Bikaner

Fig. 10 ICAR-National Research Centre on Camel, Bikaner

ICAR-National Research Centre on Camel, Bikaner, is a premier research centre of the Indian Council of Agricultural Research (ICAR). The camel is an important animal component of the fragile desert eco-system. With its unique bio-physiological characteristics, the camel has become an icon of adaptation and as "Ship of Desert". Realizing its importance, Indian Council of Agricultural Research (ICAR) established a Project Directorate on Camel at Bikaner (India) on 5th July 1984 which was upgraded to National Research Center on Camel (NRCC) on September 20, 1995 (Fig. 10). This now has animal experimental house, Agriculture Research Information System (ARIS), camel herd of about 350 camels, agro forestry rangeland of about 659 acres, camel museum and camel milk parlor.

MANDATE

1. To undertake basic and applied research for improvement of camel both one humped (*Camelus dromedarius*) and double humped (*Camelus bactrianus*) (Fig 11). 2. To provide leadership and co-ordinate camel research and training nationally and act as a national repository of information. 3. To collaborate with national and international agencies for camel research and development.

Fig. 11 Double humped camel *Camelus bactrianus*

Fig.12 Camel milk extraction and dissemination

OBJECTIVES

Above mandate is achieved by carrying out- basic and applied research on camel production and health as influenced by different farming practices; base line survey of camel genetic resources in India; draught ability; milk production potential in camel; improving reproductive performance; management of camel diseases through surveillance, monitoring and control measures; enhancing productivity by nutritional intervention; exploring camel immune system and its applicability in the diagnosis and therapy of human diseases; technology validation and its impact on socio-economic status of camel keepers; act as a repository of information on camel research and development; collaboration with national and international resources; development of human resource in the area of camel health and husbandry.

MAJOR ACHIEVEMENTS

I. Conservation of Dromedary and Bactrian Camels

The Centre is having elite herd consisting of Bikaneri, Jaisalmeri, Mewari and Kachchhi breed of camels. The molecular characterization of above breeds of dromedaries has been accomplished. The Bikaneri camels for

draught purpose, Jaisalmeri for race purpose, and Mewari and Kachchhi for Milk purpose were identified. Conservation strategies were devised and for these breeds, breed descriptors were established. For genetic improvement of camels elite 102 male camels have so far been distributed in the breeding tract of various breeds. Conservation efforts for Bactrian camels are also initiated by the Centre and there is an increase in double hump camel population from 57 in 2004 to 220 in 2015.

II. Promoting camel as Milk Animal for the arid region.

The reasons for decline in camel population from 1.0 million to 0.52 million in the last 40 years led to shift focus of camel research from its traditional use of draught to finding alternate uses for camel- including exploring its milk production potential. For this, continuous selection for last two decades have helped establish the Bikaneri, Kachchhi and Mewari as good milk breeds. The camel dairy has been established at NRCC.

The milk production potential of Indian dromedary breeds is upto 16 months on average. It gives 7 litres/day with some of the best milkers producing more than 10 litres of milk/day (Fig 12). Camel milk has lower fat with high quality higher chain fatty acids, higher percentage of free calcium, protective proteins, vitamin C, and micro minerals viz., iron, copper and zinc as compared to the cattle and buffalo milk. Better Immunoproteins status for IgG, IgA, IgM, C3 and C4 in camel blood, colostrum and milk makes its milk effective in decreasing cholesterol deposition in liver and increasing cholesterol excretion in faeces. It also has anti-diabetic effect. Autistic and mentally retarded children fed daily dose of camel milk showed recovery.

Different value added camel milk products have been developed by the Centre viz., Kesar kulfee, Soft cheese, Flavoured milk, Tea, Coffee, Rasogolla, Burfi, Camel milk powder, Gulab Jamun, Lassi, Raabri, Chocolate, Mawa, Kheer, Cheese and Paneer (Fig 13).These are sold at milk parlor in the NRCC.

Fig. 13 Different value added camel milk products

III. Complete Feeds for Camel

Complete feeds as blocks and pellets were prepared by proportionate mixing of fodders, agricultural by-products and concentrates for various classes of Camels like calves, lactating females and working camels (Fig.14).

Fig. 14 Preparation of complete feeds for camel

Determination of Region specific Status of trace elements in soil, feed and blood led to formulate area specific Mineral Mixtures. Improvement of reproductive efficiency of camel has also been achieved by various researches, surveillance, sero-monitoring of camel for prophylactic and timely control measures.

TOURIST INFORMATION

The centre has been identified as one of the important tourist places of Bikaner and is included in the tourist book. Facilities of camel riding, safari and video/photography are available for the visitors. Camel milk parlor is a special attraction because it vendors unique value added camel milk products like ice-cream, hot and cold beverages. Every year thousands of Foreign and Indian Tourists visit the Centre.

N.V. Patil
Director NRCC, Bikaner

Know Policies

NATIONAL AND RAJASTHAN WATER POLICY

National Water Policy

The emphasis of the 2002 India Water Policy(GoI,2002) was mainly on augmentation and management of water supply with following regulatory frameworks:

- Exploitation of groundwater resources should be so regulated as not to exceed the recharging possibilities, as also to ensure social equity.
- Efficiency of utilisation in all the diverse uses of water should be optimised and an awareness of water as a scarce resource should be fostered. Conservation consciousness should be promoted through education, regulation, incentives and disincentives.

A new national water policy has been drafted and circulated for comment (GoI, 2012).The current draft is conspicuous by the fact that it still seems to view India's water problems as being linked primarily to lack of water availability and/or supply rather than rapidly increasing demand. The current draft of water policy includes a section on "Demand Management and Water Use Efficiency". It also gives relatively more attention to regulation than the 2002 India Water Policy. Some of the highlights are as follows :

- There is a need for comprehensive legislation for optimum development of inter-state rivers and river valleys to facilitate inter-state coordination ensuring scientific planning of land and water resources taking basin/sub-basin as unit with unified perspectives of water in all of its forms (including precipitation, soil moisture, ground and surface water) and ensuring holistic and balanced development of both the catchments and the command areas. Such legislation needs, inter alia to deal with and enable establishment of basin authorities with appropriate powers to plan, manage and regulate utilisation of water resource in the basins.
- A portion of river flows should be kept aside to meet ecological needs ensuring that the low and high flow releases are proportional to the natural flow regime, including base flow contribution in the low flow season through regulated ground water use.
- A system to evolve benchmarks for water uses for different purposes, i.e. water foot prints, and water auditing should be in place to promote and incentivize efficient use of water. The "project" and the "basin"water use efficiencies need to be improved through continuous water balance and water accounting studies. An institutional arrangement for promotion, regulation and controlling efficient use of water will be established for this purpose at the national level.
- A Water Regulatory Authority should be established in each state. The Authority, interalia, will fix and regulate the water tariff system and charges, in general, according to the principles stated in this policy in an autonomous manner. The Authority may also have functions other than tariff systems, such as regulating allocations, monitoring operations, reviewing performance and suggesting policy changes, etc. Water Regulatory Authority in a state may also assist in resolving intra-state water related disputes.
- The "Service Provider" role of the state has to be gradually shifted to that of a regulator of services and facilitator for strengthening the institutions responsible for planning, implementation and management of water resources.

Water Policy of Rajasthan

In contrast to the National Water Policy, Rajasthan's State Water Policy (GoR, 2010) puts considerable emphasis on challenges related to increasing water scarcity and the fundamental need for regulation of demand. This is both a reflection of the severity of water challenges in Rajasthan and the willingness of the GoR to manage the supply and demand of water. Some of the features of Rajasthan's State Water policy are as follows:

- The availability of water in the State is not commensurate with the requirement of water. Deficit between demand and supply is 8 BCM and likely to increase to 9 BCM by 2015.Thus, the availability of water in Rajasthan is about 780 cubic meter per person per year as against the internationally

accepted standards of 1000 cubicmeter per person per year and is likely to reduce to 450 cubicmeter per person per year by 2045.

- Exploitation of groundwater for agriculture and other purposes other than drinking will be so managed by public participation as not to exceed the average long term recharge potential.
- The current methods of uncontrolled groundwater extraction as an 'individual right 'will be discouraged. It will be replaced by a method of community responsibility for the long term sustainability of the aquifer as a community resource.
- A programme of water metering for water management purposes will apply to all significant water users irrespective of source and water ownership.
- All water rates will be set so as to convey the scarcity value of water and to generally motivate economy in water usage. While deciding the tariff this would be kept in view that those who cannot afford to pay will not be deprived of minimum quantity of potable water.
- For all water supplies a three or four stepped water tariff will be charged with the highest rate for excessive use of water. This stepped water tariff will be set to ensure magnitude difference in water rates between the lowest and highest rates. For the first stepped rate of relatively cheap water, these rates will be common to all water users.
- Differing stepped water rates may be charged for agricultural, industrial, commercial and municipal purposes. In all cases, the highest rate will be a strong disincentive for profligate water usage.
- A legal frame work will be developed for the re-regulation and management of groundwater extraction in general and in the 'Critical and Overexploited' zones in particular. Such legislation will also address the need for compensatory water conservation and recharge measures to be taken by the bulk water consumers.
- Water Regulatory Authority will be formed.
- Total surface water available in the State is 21.71 BCM,out of which 16.05 BCM is economically utilizable. State has so far harnessed 11.84 BCM which is 72% of economically utilizable portion. In addition to it 17.89 BCM is allocated through Inter state agreements increasing their irrigation potential from 2.47 lac ha to 34.96 lac ha (including IGNP) and leading thereby to increased agricultural productivity.

Nearly 90% of the drinking water and 60% of the water required in the agriculture sector is extracted from groundwater reservoirs. Therefore, not only the groundwater has been depleted at an alarming rate but the quality of groundwater has progressively deteriorated which leads to serious health problems. Around 80% area of the state is now witnessing groundwater depletion.

Hence priority in usage of water in the declining order is likely to be:

Human drinking water ➡ Livestock drinking water ➡ Other domestic commercial and municipal water uses ➡ Agriculture ➡ Power generation ➡ Environmental and ecological ➡ Industrial-Non-consumptive uses, such as cultural, leisure and tourist uses.

Surface Water

- Preservation of traditional water harvesting structures and sources will be encouraged. Roof top rain water harvesting, storm-water harvesting, recycling and reuse of waste waters will be promoted.
- Investigations will be undertaken to quantify the potential for evaporative suppression in storage structures. Studies will be conducted to evolve methods to suppress evaporative losses and projects will be implemented accordingly.
- Efficient crop water application and utilization practices shall be encouraged by adopting modem water conservation techniques.
- The economic and technical potential for the reuse of treated waste water will be assessed in all basins.

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Knowledge Corner

Arboriculture Camouflage: a spin of benefit in desert area of Rajasthan for combating desertification

The vegetation camouflage means camouflaging by natural vegetation viz. live and cut vegetation. Needless to say that of these two techniques of camouflage, "camouflage by arboriculture" is of permanent nature and is the most effective way of natural camouflage in military operation. Although scientifically arboriculture means only tree cultivation and camouflaging by tree design, crown, canopy, cover and also tree branches used as cut foliages in temporary camouflaging (short term camouflage) during hostile period is known as arboriculture camouflage. The natural vegetation like trees, shrubs, creepers and climbers have been effectively used by armed forces in enhancing their moral efficiency in operational areas and green vegetative coverage provide shade, shelter and ecological balance. Beside protection of military objects against reconnaissance, this technique is very much effective in signature management of military objects in entire range of electromagnetic (EM) spectrum.

In visual camouflage, terrain background reflectance data of all natural features is to be obtained for whole of the year. To give concealment effect, natural vegetation is a prominent method. We can achieve effective concealment by growing tall trees near the structures and successively planting lower height trees for distortion of shadows etc. to give best camouflage. For desert terrain, tree and vegetation species selected for plantation should be capable to withstand harsh climatic condition. Plant cover can affect military tactics, decisions, and operations. Perhaps the most important is concealment. To make reliable evaluations when preparing vegetation overlays, analysts must collect data on the potential effects of vegetation on vehicular and foot movement, rover and concealment, observation, air drops and construction materials. The types of vegetation in an area can give an indication of the climatic conditions, soil, drainage and water supply. Terrain analysts are interested in trees, creepers, climbers, herbs, shrubs, grasses and also cultivated crops.

Defence forces in hot desert have to function in harsh climate and different terrain conditions, which adversely affect the operational reliability of the equipment as well as proficiency of troops. In long stretches of sand dunes and lack of sufficient vegetation in desert area of Rajasthan, camouflaging and concealment of military equipments are extremely difficult. The soldiers face extreme climatic conditions of hot desert. The problem is further aggravated by the rapidly advancing technology with military reconnaissance, surveillance and target acquisition systems. However, these problems can be adequately solved to some extent by introducing fast growing new plant species through design and implementation of site specific long term arboriculture camouflage schemes.

The *Prosopis cineraria* commonly known as Khejri is the evergreen plants of Thar desert with big crown and this has been quoted as the same sacred plant which concealed "celestial weapons" of the great Arjuna during disguise period of pandavas.

Camouflage by arboriculture is very useful tool particularly in desert area of Rajasthan. Based on extensive survey and R&D studies on indigenous xerophytic plant species of Thar desert, a lot of data have been generated by Defence Laboratory, Jodhpur. Various types of exotic plant species have been introduced and tried in a number of army units to select new plant species for adoption and growing in different phyto-geographic locations. In Field Marshal Area of Jaisalmer, Defence Laboratory has designed and implemented

Fig. 15 Plantation with Drip irrigation (2004)

Fig. 16 Inauguration by Desert Core Commander (2004)

Fig. 17 Plant growth after ten years (2014)

model arboriculture camouflage scheme as experimental purpose. Total dissolve salt (TDS) of ground water is 1200. Selected thermo-salt tolerant saplings developed in DLJ nursery were transplanted at project site. For economical and efficient water supply to the tree saplings, drip irrigation layout was designed and bore well was installed at the site for ground water source (Fig. 15&16). Three thousand and five hundred saplings of ten different plant species were planted in pits refilled with good agricultural soils and commercially available hydrogel based soil additives in addition to Farm Yard Manure (FYM). In last ten years vegetation data and satellite images were collected for camouflage efficacy and periodically monitored the area for camouflage purpose. Plants height, canopy diameter and bole diameter of transplanted saplings indicated that these are growing well and able to survive in harsh climate of Rajasthan (Fig. 17). So arboriculture in hot desert operation will continue to be effective and advantageous technique for camouflaging of military troops and terrain objects.

Large scale tree plantation in rangelands of Rajasthan for phyto camouflaging purpose also provide additional benefit: the tree canopies of transplanted plant species provide shade and gives protection to military personnel and vehicles from direct sunlight and high temperature. Gradient pattern plantation not only merge with existing vegetation of surrounding area but also provide a screen for breaking of high speed wind and act as a shelterbelt to prevent moving of loose sand and shifting of sand dune. In desert area of Rajasthan, high speed blowing sand frequently causes road blockage and hampers in transportation of vehicles and other movement. Shelterbelt plantation in military lands increases the efficiency of military activities during their exercises.

Considering camouflage and concealment properties as main objective of sand dune stabilization and shelterbelt plantation programme, the following plant species have been recommended in arboriculture camouflage applications in Thar Desert of Rajasthan. The species are *Acacia senegal, Acacia tortilis, Albizzia lebbeck, Azadirachta indica, Cassia fistula, Cassia calycina, Pongamia pinnata, Eucalyptus camaldulensis, Leucaena leucocephala, Dalbergia sissoo, Prosopis juliflora, Prosopis cineraria, Salvadora oleoides, Salvadora persica, Tamarix articulata, Ziziphus nummularia, Calotropis procera, Tecomella undulata, Calligonum polygonoides, Aerva pseudotomentosa* and *Cenchrus setigerus* grass.

Director
DRDO, Jodhpur

Events by ENVIS CAZRI

ENVIS CAZRI participates in National interaction-cum-evaluation workshop for Environment Information System (17-19 February, 2016)

ENVIS on Combating Desertification participated in the above event organized to reach out to people on environmental issues and creating more awareness among them. The ENVIS portal was launched on February-17 by the Minister of State of Environment, Forest and Climate Change, Hon'ble Shri Prakash Javadekar, at the inauguration in New Delhi. While going around stalls put up by different ENVIS centers, he evinced keen interest in ENVIS-CAZRI stall (Fig.18). He tasted the ber fruit and appreciated the efforts put in for combating desertification.

Fig. 18 Hon'ble Sh. Prakash Javadekar, Minister of State (Independent Charge) of Environment, Forest and Climate Change GoI and Ms S. Anandi, Sr. Economic Advisor-ENVIS, viewing ENVIS CAZRI Stall at National interaction-cum-evaluation workshop, New Delhi

Large number of people visited CAZRI stall (Fig. 19) and they were attended by Dr. Suresh Kumar (Co-ordinator), Dr. Ritu Purohit (Programme Officer) and Akshay Bhardwaj (I.T. Assist.) from ENVIS Centre on Combating Desertification, ICAR-CAZRI, Jodhpur. Publications of interest to farmers and general public were all exhausted

as visitors showed keen interest in them. Comments by some visitors indicate that such exhibitions have immense use for them and should be organized in each district headquarter.

ENVIS- CAZRI Celebrates World Water Day on 22nd March, 2016

World Water Day was celebrated on 22nd March, 2016 under the aegis of ENVIS at CAZRI, Jodhpur (Fig. 19). The function was chaired by Dr. C. B. Pandey, Director (Acting), CAZRI, Jodhpur. Dr. Praveen Kumar, Head of Division -II welcomed the honourable speaker and guests. Dr. Suresh Kumar, ENVIS Coordinator discussed about National Water Policy and Water Policy of Rajasthan.Dr. Dipankar Saha. Sr.Scientist introduced the invited speaker to the house. The programme was attended by around 50 people including scientists and staff of CAZRI, Jodhpur (Fig. 20 & 21).

On this occasion, "Water Management in Arid Region" was discussed in great detail by Dr. R.K Goyal with excellent slides. Dr. Goyal talked on this year theme "Water and Jobs". He also explained that approximately 40% employment is related to water and highlighted shortage of water and various methods of conserving water. Dr. Goyal also mentioned that according to Virtual Water Counting non-vegetarian food consume more water as compared to vegetarian food so "Be vegetarian and save water."

Dr. C.B Pandey, Director (Acting) also discussed about importance of water in our life. ENVIS Coordinator Dr.Suresh Kumar discussed about ongoing ENVIS activities and invited scientists to contribute write ups for publication in ENVIS Newsletter.

At the end, vote of thanks was presented by Sh. Tirth Das, Member Secretary, ENVIS. The programme was compered by Dr. Shweta Mathur, Information Officer, ENVIS, CAZRI, Jodhpur.

Fig. 19 Exhibition Stall of ENVIS-CAZRI being visited by Guests

Fig. 20 Water Day Celebration at ICAR-CAZRI. Jodhpur

Fig. 21 Eminent Scientist and ENVIS Team at ICAR-CAZRI on World Water Day

Compiled by ENVIS Team
CAZRI, Jodhpur

Conferences

S.No.	Date	Event	Place
1	January 11 -13, 2016	International Conference: Education as a Driver for Sustainable Development Goals	CCE, Ahmedabad, India
2	February 7-14, 2016	Seventh International Conference of the African Soil Science Society (ASSS)	Ouagadougou, Kadiogo, Burkina Faso
3	March 3-4, 2016	ICWE 2016 : 18th International Conference on Wind Engineering	Singapore, SG
4	April 25-26, 2016	International Conference on Pollution Control & Sustainable Environment	Dubai, UAE

S.No.	Date	Event	Place
1	August 29 – September 1, 2016	Eco Summit 2016: Ecological Sustainability: Engineering Change	Le Corum, Montpellier, France
2	May 26-27, 2016	ICEWRM 2016 : 18th International Conference on Environment and Water Resource Management	Tokyo, Japan
3	May 23-27, 2016	"Adaptability of Agriculture and Conservation Systems in a Changing Environment" Agro Environ 2016: 10th Internationa l Symposium on Agriculture and the Environment	Stewart Center, Purdue University West Lafayette, Indiana, USA

News

राज्य में हाइड्रोफोनिक तकनीक से ग्रीन हाउस में होगी खेती

अब बिना मिट्टी के खेती

हाइड्रोनिक तकनीक से होने वाली खेती में मिट्टी का नहीं होता उपयोग

ब्यूरो/ नवज्योति, जयपुर

प्रदेश में अब बिना मिट्टी के भी ग्रीन हाउस में खेती करने की तैयारी की जा रही है। ग्रीन हाउस में 'हाइड्रोफोनिक तकनीक' से खेती की जाएगी, जो बिना मिट्टी की मदद से पक्के आंगन या प्लास्टिक बिछाकर के भी की जा सकती है। राज्य में हाइड्रोफोनिक तकनीक से खेती करने से ग्रीन हाउस में निमिटोड जैसी बीमारियों के पनपने का खतरा समाप्त हो जाएगा। इस तकनीक से खेती करने से शिमला मिर्च, टमाटर, धनिया और स्ट्रोबेरी की खेती बेहतर तरीके से होती है। राज्य के कृषि मंत्री प्रभुलाल सैनी ने उद्यानिक विभाग को संभाग स्तर पर खेती करने के निर्देश दिए हैं। पायलट प्रोजेक्ट के तहत बस्सी स्थित डीडोल और टोंक जिले के देवडावास में नई तकनीक से खेती की जाएगी।

बिना मिट्टी के कैसे होगी खेती

ग्रीन हाउस में हाइड्रोफोनिक तकनीक से खेती मिट्टी की बजाए नारियल का चूरा और प्लास्टिक के ऊपर की जाती है। हाइड्रोफोनिक का अर्थ होता है-बिना मिट्टी के खेती से होता है। इसमें हाइड्रोफोनिक की प्लास्टिक की नालियां लगाई जाती है, जिसमें सब्जी की बेल लगाई जाती है। नालियों में ही पानी की सप्लाई होती है।

काफी महंगी है तकनीक

हाइड्रोफोनिक तकनीक से खेती किसान के लिए काफी महंगी है। सूत्रों के अनुसार चार हजार वर्ग मीटर में ग्रीन हाउस में खर्चा करीब 28 लाख रुपए आता है, जबकि ग्रीन हाउस लगाकर उसमें हाइड्रोफोनिक तकनीक से खेती करने पर अतिरिक्त खर्चा करीब चालीस लाख रुपए और आता है। ऐसे में करीब चार हजार वर्गमीटर में हाइड्रोफोनिक तकनीक से खेती करने पर खर्चा करीब 70 लाख रुपए के आस-पास आता है।

विभागीय निर्देशों के तहत पायलट प्रोजेक्ट के तहत हाइड्रोफोनिक तकनीक से खेती करने की उद्यानिक विभाग ने तैयारी शुरू की है। हालांकि, काफी महंगी योजना है,लेकिन इसमें किसान को फायदा ही होगा।

-शरद गोधा,अतिरिक्त निदेशक, उद्यानिक विभाग,राजस्थान

काजरी का शोध | अब ऑफ सीजन में खीरा की अधिक हो सकेगी उपज

सिटी रिपोर्टर| जोधपुर

ऑफसीजन में अब खीरा सैलेड की प्लेट से गायब नहीं होगा। काजरी के वैज्ञानिक इन दिनों कद्दू, लौकी, तरबूज और इसी श्रेणी की सब्जियों पर शोध कर कोशिश कर रहे हैं कि ऑफ सीजन में खीरा की अधिक पैदावार ली जा सके। इस संबंध में काजरी के संरक्षित खेती विभाग के प्रधान वैज्ञानिक डॉ. अनुराग सक्सेना शोध कर रहे हैं। सक्सेना ने बताया कि काजरी परिसर में बने पॉली हाउस में नई तकनीक का उपयोग करते हुए सामान्य से कम तापमान पर बूंद-बूंद ड्रिप से कम पानी में खीरे का परीक्षण किया जा रहा है। इन चार जातियों में से किस पर अधिक खीरा का उत्पादन होगा? जिस किस्म से खीरे का ज्यादा उत्पादन मिल जाएगा, यह जांचने और परखने के बाद वह किस्म किसानों को समर्पित की जाएगी। उन्होंने बताया कि इस परीक्षण में खीरे पर कीड़ा अथवा कोई रोग लगे और अधिक उत्पादन हो ताकि किसान ऑफ सीजन में अधिक उत्पादन कर आय अर्जित कर सके और सलाद के लिए खीरा प्रचुर मात्रा में मिल सके।

सातकिस्में पहले से उपलब्ध| डॉ. सक्सेना ने बताया कि टर्मिनेटर, डायना माइड, 51-53, रीका, इनफिनिटी, इकरान और क्यान सहित कुल सात किस्मों की खीरा सब्जी का परीक्षण इसी पोली हाउस में किया गया और एक पौधे से डेढ़ किलो उत्पादन लिया गया। अब इस पैदावार को और बढ़ाने पर काम किया जा रहा है।

ENVIS CAZRI Website

Following Statistical Databases of Rajasthan (Arid Zone) can be accessed in CAZRI-ENVIS Website

- Crops- Area, Production and Productivity
- Rainfall Distribution
- Human Population - Rural, Urban
- Livestock - Cattle, Buffalo, Sheep, Goat, Camel, Poultry
- Working Human Population
- Density of Human Population
- Sex Ratio
- Irrigation by Canal, Tank, Wells, Tubewells
- Agricultural Equipments - Animal Cart, Electrical Pump set, Oil Engine Pump Set, Plough, Tractor
- Fertilizer Consumption
- Landuse Pattern - Forest, Barren and Uncultivated land, Cultivated waste land, Current Fallow, Net Area Sown, Non Agriculture Use, Old Fallow, Pasture and Grazing, Trees and Groves
- Electricity Consumption - Industrial, Commercial, Domestic and Residential Uses
- Temperature
- Humidity
- Mineral Production

Compiled by Shweta Mathur and Akshay Bhardwaj
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