

Entrepreneurship through Khejri Technology

Khejri (*Prosopis cineraria*) is a versatile tree of Thar Desert and well-known for its nutritious immature green pods (*sangri*) and leaf-fodder (*loong*), and exerts favourable effect on soil and environment in the arid and semi-arid areas of north-western India. Khejri not only tolerates the extreme edapho-climatic conditions but the lush-green plants also bear flowers and pods during peak summer months. ICAR-CIAH, Bikaner has made a series of technological interventions for its systematic promotion which includes clonal multiplication for uniform plantations, varietal improvement for high-quality harvest from thornless plants, orchard establishment models for maximizing resources efficiency, crop regulation to harvest both *sangri* and *loong* annually, value addition, packaging and marketing protocol for better income generation as nature's resilient farming system approach.

KHEJRI (*Prosopis cineraria*) is a multi-function flora of Thar Desert. Its seedling grows naturally and trees are found abundant under the inhospitable arid climate of India. It is the lifeline tree of the desert and is promoted extensively because of its significance to local inhabitants for food and fodder, besides its favourable impact on the ecosystem. It is the most important component of the traditional farming systems and tolerates extremely high and low temperatures, and the lush green foliage in summer bears fruits too. The immature pods (*sangri*) are used widely both fresh and dehydrated for vegetable culinary, and sold at high prices (@ 200 & 800 /kg, respectively). *Sangri* is the main constituent of *Panchkutta* vegetables and it is rich in minerals such as potassium, magnesium, calcium, zinc, iron and in addition a good source of protein and dietary fiber. *Sangri* also contains high antioxidants, phenols, flavonoids and saponins, which boost immunity and reduce bad cholesterol in the blood.

For horticultural harnessing of khejri, a series of technological advancements were made from year 2000 to 2020 at ICAR-CIAH, Bikaner and recommended are bud-grafting or patch-budding for vegetative propagation and mass-multiplication of plants in the nursery, *in-situ* orchard establishment by bud-grafting, induction of thornlessness in plants, variety Thar Shobha and Thar Amruta, crop-regulation practice for harvesting both *sangri* and *loong* annually, on-farm value addition, and low-input and diversified crop-combination models adopting the HBCPSMA like organic *Panchkuta*, native, multi-purpose and intensive crop production technology.

Recently, farmers have shown much interest in commercial orcharding of khejri varieties because of their horticultural significance in particular to dwarf plant stature and ease in canopy management, thornless,

uniform quality pods (*sangri*), regular and high yield of good quality leaf-fodder. However, harvesting, post-harvest handling, processing techniques and packaging have not been standardized so far. Therefore, ICAR-CIAH, Bikaner has further taken initiative in this direction and protocols were developed for value addition, packaging and marketing of *sangri* as branded product.

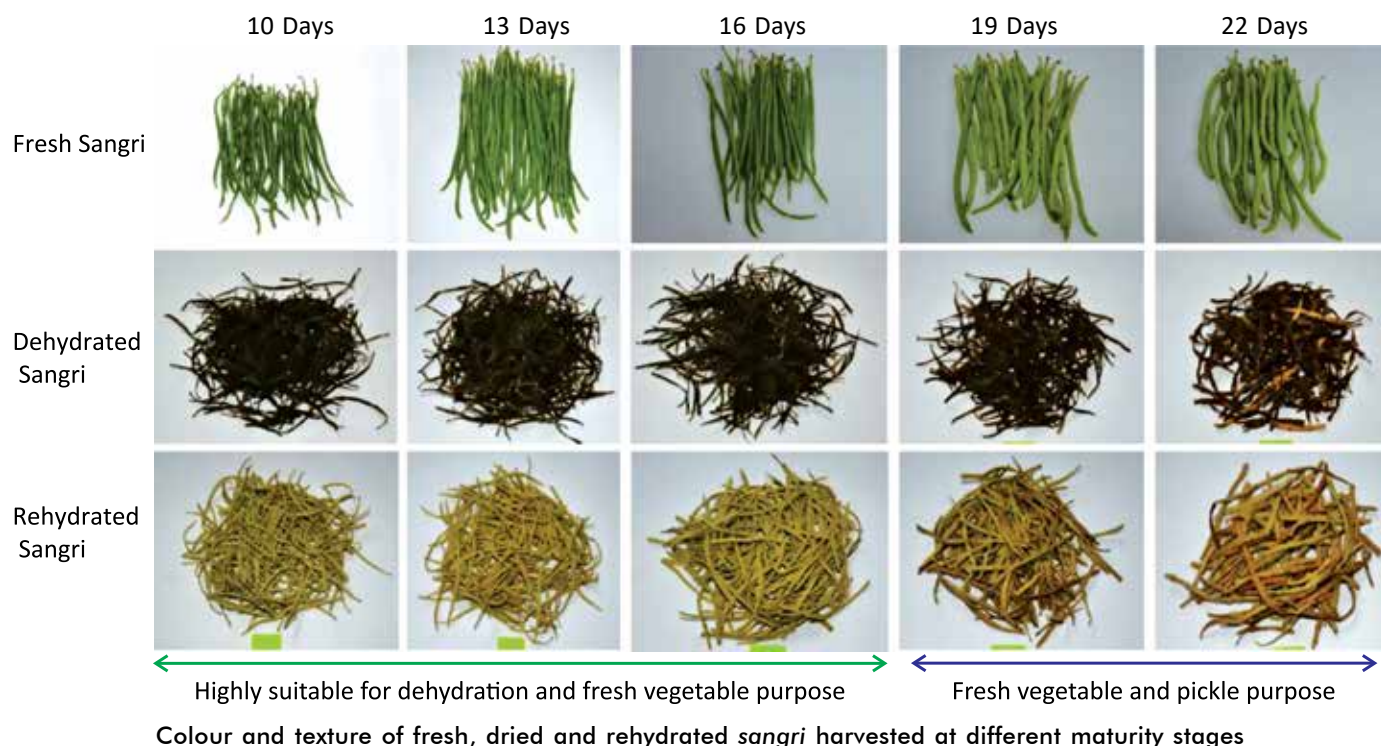


Nature's resilient horticultural crop-plant production models with khejri under sand-dunes landscape

Standardization of horticultural maturity indices

Tender pods of specific maturity stage are required for getting good quality dehydrated *sangri*, and therefore, to identify the ideal harvesting stage, maturity indices have been standardized. Pods harvested at 3 days intervals *i.e.* 10, 13, 16, 19 and 22 days after setting were used, and blanched, dehydrated and cooking parameters along with sensory attributes were studied.

Rehydration percentage is directly proportional to the quality of the dried product and it is used as an indicator for dry product quality. The green pods harvested after 10, 13 and 16 days of pod setting showed high rehydration per cent *i.e.* 296, 289 and 287, respectively. However, rehydration per cent was significantly reduced (256 and 216) in pods harvested after 19 and 22 days of



setting. Dried *sangri* colour is an important parameter for marketing and black colour fetches maximum prices while brown *sangri* is not liked by consumers. *Sangri* harvested between 10 and 16 days after pod setting attained black colour after drying and light green after rehydration while *sangri* harvested at later stages showed brown colour post-drying and rehydration. Based on the study, it is recommended that green pods of Thar Shobha should be harvested between 10 to 18 days of pod setting, 1.0-2.5 mm thickness and deep green to green colour stage for vegetable and dehydration purposes. The consumer acceptance for vegetable purpose is diminished in *sangri* harvested between 19 and 25 days after setting but it can be nicely utilized for pickle making and cooked vegetables like beans.

Harvesting: Manual picking is recommended and to harvest a maximum quantity of good quality tender pods, 3-4 pickings are essential in a tree and it should be at 3-4 days intervals from the 2nd fortnight of April to the First fortnight of May month. Before processing, under-size and over-matured pods should be separated from the tender

Pods to obtain uniform quality dried product.

Blanching: Blanching is an important practice during processing to obtain superior quality dried *sangri* with desirable colour and texture. With different blanching treatments, we found the 5-minute period of blanching in boiling water is ideal for *sangri*. After blanching, pods should immediately be dipped in cold water for 5 minutes to prevent overcooking. After that pods should be removed from cold water and spread on clean cotton cloth or aluminium/steel tray in a single layer for drying.

Drying: *Sangri* pods are usually dried in open sunlight by farmers and rural women. The drying method followed by farmers is not very appropriate because produce is exposed to dust, insects, rodents and birds. The product obtained by open sun drying is unhygienic and also of inferior quality in terms of colour. Therefore, ICAR-CIAH, Bikaner has designed and fabricated a simple and low-cost tunnel-type drying structure for hygienic drying of khejri pods. Dimensions of the drying structure are 260 cm length, 120 cm width, 45 cm tunnel height, and 70 cm height from ground surface. This structure is fitted with



Manual harvesting of green tender pods of khejri variety Thar Shobha



Sangri drying in CIAH solar drying structure

48-volt DC exhaust fan operated by solar panel. In one intake, 25 kg fresh produce can be dried in this structure. In the solar dryer, *sangri* is dried within 8 hours and retains better colour and good sensory properties while in open sun 24 hours have been taken for drying. The drying recovery of *sangri* depends on harvesting stages and varies between 25.86 to 28.05% of fresh produce. ICAR-CIAH solar dryer is highly suitable for on-farm drying of *sangri* as well as other native fruits and vegetables because it is portable, easy to handle and fabricate locally and also low-cost.

Packaging and labelling: Dried *sangri* is sold in retail market at premium prices *i.e.* 800-1000/kg by traders. Although, it is procured from farmers by middlemen at low prices *i.e.* 400-500/kg and a big share of retail price is grabbed by middlemen and retailers. Therefore, in order to maximize farmers' profit, we have standardized packaging and labelling for direct marketing of *sangri* to consumers. Dried *sangri* was packed in food grade standee pouches and plastic boxes of 100, 200, 250, 500 and 1000 gram storage capacity and labelled. Labels include information regarding quality, nutritional value, method of consumption, storage information and contact details. During marketing, package of 250 g capacity is



Packaging and labelling of dried Sangri for direct marketing

found to be most suitable for retail marketing directly to consumers as a family pack. This method of packaging and marketing is demonstrated to the rural women and farmers to remove middlemen from *sangri* marketing chain.

Conclusions: Khejri is the lifeline tree of desert ecology, providing livelihood, supporting livestock and rendering environmental services since ancient times. In the era of liberalization, globalization and commercial agriculture, cultivation of khejri varieties in resource constraint arid environments along with value-addition, packaging, labelling and marketing can provide sustainable income to the farmers in the form of high-value dried sangria and nutrient-rich fodder. In addition, khejri plantations also provide low-cost domestic fuel from pruned twigs and minimize the ill effects of extreme climates. Scientific management of the developed plantations to get a high yield of fresh produce would add value to the already existing lucrative trade in dehydrated *sangri*, provide assured income to farmers, and offer entrepreneurship opportunities for rural women and farmers.

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Success Story

Germplasm Indigenous Sources

Shri M. Sankara Rao is a marginal farmer, belonging to a remote village of Naiduvalasa of Rambadrapuram Mandal of Vizianagaram district in Andhra Pradesh. He is an ex-trainee of KVK, Vizianagaram. Having gained knowledge and skill in nursery, he established nursery unit with "mini-shade net" under the technical guidance of KVK faculty. He raised seedlings of different vegetables and papaya under mini-shade net (60 sq m) and produced high quality virus-free papaya seedlings (2,500) and vegetables seedlings, viz. Tomato (5,000), Brinjal (5,000), Chilli (5,000) during May 2021 to October 2021, with which, he received a net income of ₹ 25,700. Farmers from the neighbouring villages got attracted with the benefits gained by protected shade-net nursery production; and accordingly, approached KVK, Vizianagaram for further guidance to adopt the technology.



A view of nursery unit of Shri M. Sankara Rao with mini-shade net

Source: ICAR-Annual Report 2022-23