Vishal Singh Rana[1]*, Dinesh Singh Thakur and Pooja Kumari

Chinese jujube: A new potential introduction for diversifying fruit cultivation in Himachal Pradesh

Horticulture in Himachal Pradesh is increasingly challenged by climate variability, declining productivity of traditional crops, and market uncertainties. In this context, Chinese jujube (*Ziziphus jujuba* Mill.) emerges as a promising alternative for diversification. Introduced from Australia and evaluated across altitudes of 900–2,000 m, the crop has shown encouraging adaptability, early bearing, and suitability to diverse soil and climatic conditions. Its tolerance to drought, temperature fluctuations, and low input requirements makes it ideal under changing climate scenarios. Preliminary trials with varieties *'Li'* and *'Chico'* indicate good establishment and fruiting potential in mid- and low-hill regions. Additionally, its high nutritional value and scope for value addition enhance market prospects. Chinese jujube thus holds significant potential for sustainable and profitable fruit cultivation in the region.

Keywords: Climate resilience, Extreme temperature and water stress, Himachal Pradesh, Rootstocks, Value addition

THE horticulture industry in Himachal Pradesh is increasingly challenged by the uncertainty of global climate change, as most of the arable area is rainfed. Orchardists often remain uncertain about returns due to risks associated with weather variability and fluctuating market conditions. Existing fruit crops, particularly apple, have shown a decline in productivity, coupled with increasing incidences of biotic and abiotic stresses. However, some emerging fruit crops such as kiwifruit, pear, plum, persimmon, and strawberry have demonstrated promising potential in recent years. More recently, Chinese jujube has been introduced by Dr YSP UHF, Nauni, Solan (Himachal Pradesh), from Australia after obtaining the necessary import permit from NBPGR, New Delhi. It has been planted across different agroecological locations ranging from 900 m to 2,000 m above mean sea level. Preliminary observations indicate its potential for commercial cultivation in the Shivalik foothills and mid-hill regions, including Solan, Shimla, Sirmour, Hamirpur, and Kangra districts. In the current context, the introduction of hardy, non-traditional fruit crops like Chinese jujube, with wide climatic adaptability, could prove to be a valuable asset for future fruit farming.

Origin and importance

The jujube (*Ziziphus jujuba* Mill.), also known as Chinese jujube, is one of the oldest cultivated fruits in the world and belongs to the family Rhamnaceae. It holds considerable economic, ecological, and social importance. Its cultivation dates back to the Neolithic period, around 7,000 years ago, and it is believed to have originated from its wild relative *Z. spinosa* Hu. The Indian jujube (*Ziziphus mauritiana* L.) is widely cultivated in the Indian subcontinent for its fresh fruits and medicinal value, particularly in Ayurvedic preparations, and thrives in dry and marginal ecosystems. In contrast, Chinese jujube is a cold-hardy, deciduous species known for its excellent dehydration quality and high vitamin C and P content. In China, it has long been used both as food and in traditional medicine. The fruits are consumed fresh, dried, or processed into products such as bread, cakes, candy, chutney, pasta, purees, syrups, and jams. Dried fruits are also commonly used in porridges and broths, especially during festive occasions.

Botanical description

Chinese jujube exhibits wide adaptability to diverse soil types and climatic conditions. The plant is a deciduous tree, typically 15–30 feet tall, with hard and durable wood. Branches are often crooked, and young plants bear paired thorns. The canopy may range from wide-spreading to upright forms. Leaves are shiny, oval to elliptical, and arranged alternately on the branches. The flowers are small, fragrant, pale greenish-yellow, and appear singly or in clusters in the leaf axils. A distinctive feature of Chinese jujube is that flowering, fruit set, and fruit development occur within a single growing season. Botanically, the fruit is a drupe with a central stone containing up to two

seeds. Fruit size varies from thumb-sized to golf ball-sized, depending on the variety, and shapes range from round and oval to oblong and apple-like.

Pollination, bearing and yield: Most varieties are self-fruitful, although cross-pollination enhances fruit set and yield. Therefore, planting two or more varieties is recommended. Pollination is facilitated by insects such as ants, honeybees, wild bees, hoverflies, houseflies, and ladybirds. Jujube plants are precocious, bearing fruits within two to three years of planting, with reasonable yields achieved after four to five years. A mature tree can produce 18–40 kg or more of fruit, depending on variety, management practices, and location, and can remain productive for over 50 years. The crop performs well across a wide range of soil types–from sandy to clayey–and soil pH (6.0–8.5). It is drought-tolerant and generally easy to manage, although young plants require care similar to other fruit trees.

Fruit development and harvesting: Fruit colour changes from dark green to yellowish-green at the onset of ripening, followed by the development of brown or red spots. Eventually, the fruit turns fully red to reddish-brown, indicating maturity. As ripening progresses, the texture softens and the surface wrinkles. Fruit maturity is often non-uniform. Fresh fruits can be harvested from the creamy stage to the fully red stage while still firm. Fruits can be stored at 4°C for up to two weeks. Fully red fruits are preferred for drying, and manual harvesting is recommended.

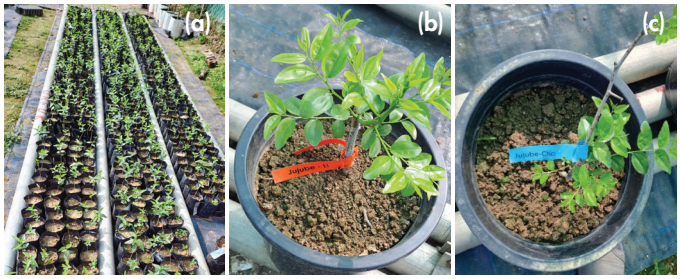
Jujube is cultivated in over 50 countries, with China accounting for more than 90% of global production and a significant expansion in cultivation over the past three decades. In Himachal Pradesh, fruit cultivation is increasingly threatened by climate change, pest and disease pressures, and post-harvest losses. Considering the growing global popularity and economic importance of jujube, its commercialization as a new crop could play a vital role in horticultural diversification and expansion in the state.

Scope of jujube in Himachal Pradesh

Two varieties, *viz.,* 'Li' and 'Chico', along with seeds of three rootstocks, namely Jin Si Lin, Mystal, and P. Hybrid, of Chinese jujube were introduced by Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan (Himachal Pradesh), from Australia at the Regional Horticultural Research and Training Station, Dhaulakuan, Sirmour, in 2023. The plants of these varieties have been established at four different locations for multilocation testing across elevations ranging from 900 m to 2,000 m above mean sea level. The plants started bearing fruits in 2024, with higher yields expected in the summer season of 2025. In addition, rootstocks have been evaluated, and seedlings have been planted in the mid- and low-hill regions of Himachal Pradesh. The two commercial varieties have been successfully grafted onto the three rootstocks.

Table 1. Germination of different Jujube rootstocks

Rootstock	Seeds sown	Germinated	Germination (%)
Jin Si Lin	500	317	63.40
Mystal	475	228	48.00
P. Hybrid	475	278	59.00



(A) Germinated seedlings of Jujube rootstocks;
(B) Variety Li in Pot; and (C) Variety Chico in Pot

Table 1 presents the germination performance of three jujube rootstocks in the foothills of Himachal Pradesh. The Jin Si Lin rootstock recorded the highest germination percentage among all the rootstocks. A few fruits were also obtained from the imported plants. The preliminary results regarding the adaptation and fruiting of this new crop are encouraging at the experimental sites. After comprehensive evaluation and performance assessment over a period of 3–4 years, standardized propagation and cultivation practices can be developed for the commercialization of jujube as a potential fruit crop for diversification of hill horticulture.

Climate suitability

Himachal Pradesh experiences a wide range of

Flowering in Li and Chico variety of Jujube at RHR &TS, Dhaulakuan, District Sirmour

(A) Fruiting in Jujube at Dhaulakuan, Sirmour;
(B) Mashobra, Shimla

temperatures due to its varied topography. The lower and mid-hill regions provide ideal conditions for jujube cultivation. The crop thrives at temperatures between 25°C and 35°C, which align well with the prevailing conditions in these areas. Owing to its cold tolerance, jujube can also be successfully cultivated at higher altitudes, i.e., above 2,000 m, particularly in the context of rising temperatures due to climate change. Its ability to withstand cold spells and frost offers a significant advantage in higher elevations. Furthermore, being a drought-tolerant crop, jujube is well-suited to cope with irregular monsoon patterns and reduced water availability anticipated under changing climate scenarios.

Adaptation to climate change

With rising global temperatures, Himachal Pradesh is likely to experience more frequent heat waves and warmer winters. Chinese jujube, due to its tolerance to high temperatures, can serve as a reliable alternative in areas becoming less suitable for traditional fruit crops such as apple and other stone fruits, which are sensitive to heat stress. Under conditions of reduced rainfall and erratic water supply, jujube's ability to grow in water-limited environments provides a distinct advantage over water-intensive crops. Its low water requirement makes it particularly suitable for regions facing water scarcity, especially in the semi-arid zones of the state.

Economic and market potential

Chinese jujube is a high-value fruit with significant nutritional benefits, being rich in vitamin C, antioxidants, and other bioactive compounds. This makes it attractive for both fresh consumption and value-added products such as dried jujube, jams, juices, and herbal preparations. Increasing consumer awareness regarding health and immunity has further enhanced the demand for jujube-based products in international markets. Moreover, the growing preference for organic and functional foods presents a promising opportunity for jujube cultivation in Himachal Pradesh. Additionally, its cultivation in the scenic landscapes of the state could promote agro-tourism, allowing visitors to experience harvesting and local processing. This potential is particularly relevant for districts such as Kangra and Kullu, which are known for their natural beauty and increasing interest in sustainable tourism.

Environmental and sustainability benefits

Jujube cultivation can enhance soil fertility through its deep root system, which helps reduce soil erosion and improve soil structure. This is particularly important in hilly regions such as Himachal Pradesh, where soil conservation is a major challenge due to heavy rainfall and steep terrain. As a hardy and long-lived tree, jujube contributes to carbon sequestration, thereby helping to mitigate the effects of climate change. Compared to traditional fruit crops such as apple and citrus, jujube requires minimal chemical inputs, making it a more sustainable and eco-friendly option under changing climatic conditions.

Challenges and considerations

Although jujube is relatively pest-resistant, it remains susceptible to certain pests, including fruit flies, and to fungal diseases, particularly under humid conditions. These challenges may intensify with increased rainfall and unpredictable weather patterns associated with climate change. Despite its suitability to the agro-climatic conditions of Himachal Pradesh, jujube remains under-researched and unfamiliar to many farmers. Therefore, capacity building, training, and extension services will be essential for its wider adoption. Additionally, investments in infrastructure, irrigation, and market development are required. Although jujube has promising market potential, it is still a niche product in India; hence, increasing consumer awareness through effective marketing strategies will be crucial for its successful commercialization.

SUMMARY

The cultivation of Chinese jujube in Himachal Pradesh holds significant potential, particularly in the context of climate change. Its ability to withstand extreme temperature and water stress conditions makes it an ideal crop for the evolving agro-climatic scenario of the region. The growing demand for health and wellness products, coupled with its environmental and economic advantages, positions jujube as a sustainable and profitable option for orchardists. However, successful adoption will depend on addressing challenges related to pest management, market development, and capacity building. With appropriate support from government agencies, research institutions, and the private sector, Chinese jujube could emerge as a key crop contributing to both economic growth and environmental resilience. Its adoption can provide farmers with diversified income sources, enhanced profitability through value addition, and improved resilience to climate-related risks, making it a promising option for hill horticulture in Himachal Pradesh.

For more information, please write to:
[1]Joint Director, Research (Horticulture), Department of Fruit Science Dr Y S Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh. *Corresponding author's email: drvishaluhf@gmail.com

Movable screens in rose production

- Use movable screen, an important tool for rose cultivation.
- It can help growers manipulate environment conditions — lowers temperature, changes humidity and influences production numbers.
- The movable screens can be used year-round and in a variety of climates — from the Netherlands to India.