

Pecan nut cultivation: A profitable opportunity in Himachal Pradesh

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Pecan nut also fondly called the 'queen of nuts', offers an exciting opportunity for diversification of farming systems in Himachal Pradesh. At present, pecan orchards are found in limited areas of Himachal Pradesh, mainly Kangra, Kullu, Mandi, and Solan districts covering only 700 hectares. Despite the small area, the favourable agro-climatic conditions of these hills can support commercial-scale expansion. With scientific orchard management, use of improved varieties, and proper pest and disease protection, pecan can emerge as a profitable crop for the region. The article provides the importance of pecan cultivation by presenting its origin, nutritional richness, production technologies, global and Indian market scope, orchard establishment methods, intercropping opportunities, and integrated management practices. With proper awareness and adoption of technology, pecans can become a sustainable source of higher family income for Himachal growers while also catering to India's rising demand for exotic nuts.

Keywords: Chamba, Farmer profitability, Horticultural diversification, Nut production technologies

PECAN (*Carya illinoensis*), a member of the walnut family Juglandaceae, is a long-living, large deciduous tree that produces highly prized nuts rich in oil and flavour. The name 'pecan' comes from the Native American Algonquian language that means 'a nut requiring a stone to crack,' reflecting the hard shell protecting its delicious kernel. This tree is native to the Mississippi Valley region of North America, where over centuries farmers and breeders have improved it into the 'queen of nuts,' a title earned because of its high value and superior quality. Today pecan is grown and enjoyed worldwide, recognised as an ingredient in premium chocolates, bakery products like pies and cookies, ice creams, and confections. The oil extracted from pecan nuts is used both for cooking and in soap and perfume manufacturing. The wood of the tree is also valuable, known for its strength and beauty,

and used in furniture making and fine cabinetry. However, in India, its production volumes remain low compared to global standards to meet the growing urban and cosmopolitan demand. Pecans were introduced to India as early as 1935, but their cultivation has remained limited to small areas, mainly in the Nilgiri Hills, Jammu & Kashmir, and Himachal Pradesh. The mid-hill regions of India, particularly Himachal Pradesh, offer ideal environmental conditions for pecan cultivation. The climate of Himachal's mid-hills, with its cool winters, warm summers, and fertile, well-drained loamy soils, matches well with pecan's growth requirements. This makes it conducive to growing healthy pecan orchards with quality nut production.

Farmers are mostly growing nut crops like walnut, almond and chestnut for many years in

Himachal Pradesh. These crops suit the local weather and give good returns. Walnut and almond trees are commonly seen in mid and high hill regions, while chestnut is also grown in some places. Recently, some farmers have started showing interest in pecan cultivation by looking at the success of pecan growers and easy to compare with their own farming, farmers can better understand whether pecan can be a good option for their land and climate.

In Himachal Pradesh, apple is the main source of income for many farmers, but its production is becoming uncertain due to changing weather, higher input costs, and frequent disease problems. Walnut trees take many years to start giving good returns and prices often fluctuating in the market. Compared to these crops, pecan nut trees, once established, require less day-to-day care and produce

nuts that fetch better prices. In recent years, farmers in districts like Kangra, Mandi, Solan, and Kullu have begun experimenting with pecan cultivation and successfully produced nuts of excellent quality.

Pecan crop is rewarding opportunity for farmers to diversify away from traditional cereal crops or low-income horticultural crops based farming system. Pecans thrive under conditions of about 400 chilling hours during winter. Soil requirements include deep, fertile, well-drained loams with good organic matter content and pH ranging from 5.5 to 7.5, all characteristics found in the hilly terrains where pecans are currently grown. Maintaining soil moisture through careful irrigation during flowering, nut setting, and kernel filling stages is vital for higher yields and nut quality.

Moreover, pecans trees provide income over many years, mature trees producing 15–35 kg of nuts annually under good management practices. The crop also supports environmental sustainability as pecan trees sequester carbon, reduce soil erosion, and improve biodiversity in mixed cropping systems common in the hills. The combination of high nutritional

value, favourable environmental adaptability, premium market prices, and ecological benefits pecan becoming an ideal crop for Himachal Pradesh farmers seeking sustainable and profitable farming options. Establishing pecan orchards can improve rural livelihoods, meet growing consumer demand for exotic nuts, and contribute to the diversification and resilience of hill agriculture.

Nutritional and health benefits

Among nuts, pecan stands apart due to its nutrient density and unique flavour. A hundred grams of kernel provide nearly 691 kilocalories, higher than most other nuts, and supply a healthy balance of protein (9.17 g), carbohydrates (13.86 g), and an impressive 71.9 g fat content, most of which are unsaturated fatty acids. Pecans contain zero cholesterol, which makes it heartfriendly, and also provide significant dietary fibre (9.6 g) that supports digestion. It is a robust source of Vitamin A (56 IU), Vitamin E (24.44 mg), magnesium (121 mg), phosphorus (277 mg), and iron (2.53 mg), all of which play key roles in maintaining immunity, bone strength, and blood quality.

For women, pecans have been

associated with a reduced risk of gallstones. Its rich antioxidant profile helps in reducing oxidative stress and slowing early ageing. Pecans are also recommended for people managing type II diabetes due to their ability to stabilise blood sugar levels. The combination of nutritional benefits and delicious flavour, increases global consumers of pecans among premium supernuts. This demand translates into consistently high market prices, particularly in festive seasons when bakery and confectionery industries push demand upward.

Production and market opportunities from global to local

The worldwide pecan market is growing well. In 2024, its value was about 2 billion US dollars, and it is expected to grow to nearly 3.6 billion dollars by 2034. Pecan production worldwide is around 120,000–130,000 tonnes each year. The United States is the biggest producer, getting more than half of this amount. New Mexico and Georgia are the top states growing pecans in the US. Mexico is major producer and contribute about 40% of the world's pecans. South Africa is also growing quickly as a pecan producer. Looking at exports, the global pecan export market was worth about 2.4 billion dollars in 2023. The US leads exports with over 58% of the market, followed by Mexico and South Africa. The top pecan types that bring in the most export money are 'Desirable' and 'Wichita'.

India's pecan market is still emerging, but metropolitan retail prices reflect the fruit's premium positioning, often ranging between ₹1,200 and ₹1,500/kg. During festive and wedding seasons, prices can climb higher due to increased demand for premium dry fruits in chocolates, cakes, and specialty sweets. Farm-gate prices for Indian growers are typically in range of ₹500–700/kg, significantly more profitable compared to staple crops like maize or wheat. A well-maintained mature pecan orchard in Himachal Pradesh can yield around 1.5–2 tonnes of kernels per



Pecannut (Monoecious) tree

hectare annually, growers stand to earn net returns estimated between ₹9–12 lakh per hectare. This level of income substantially surpasses the traditional crops, additionally offering a lucrative diversification opportunity for mountain farmers. Overall, the recent trends confirm that pecan cultivation in India, particularly in Himachal Pradesh, aligns well with rising global market demand and premium pricing. With the adoption of better scientific production technologies, farmers can tap into this expanding niche market while contributing to India's self-reliance in exotic dry fruits.

Support from government and horticulture departments for new nut crops

Farmers interested in growing new nut crops like pecan can get support from government horticulture schemes. Under the Mission for Integrated Development of Horticulture (MIDH), financial and administrative handholdings are available for orchard establishment, planting material, and training. The National Horticulture Board (NHB) also provides guidance and assistance for commercial horticulture. In addition, the state horticulture department offers subsidies and technical advice, and farmers can contact their district horticulture office for details and application procedures.

Climate and soil requirements

Himachal Pradesh's natural climate makes it promising for pecan production. Pecans are adapted to humid conditions with an annual rainfall of 760 mm. It can endure summer temperatures reaching up to 27°C and withstand extreme heat ranging from 41–46°C, while their winter temperature requirement lies between 10°C and -1°C, with extremes varying from -18°C to 29°C. This unique adaptability to both hot summers and harsh winters make them suitable for a wide belt of the midhills of Himachal. Soil suitability is another important factor, as pecans thrive best on deep, fertile, well-drained loams. Prolonged water stagnation or poorly drained heavy clays attracts root-prone

Table 1. Growth and floral characteristics of pecan trees

Aspect	Description
Tree size	A pecan tree is tall and long-lived, typically growing 20–40 m in height. A 10-year-old sapling under good care is about 5 m tall and enters the bearing stage.
Trunk and wood	The trunk is straight with strong, dark hardwood. The wood is dense and used for furniture and cabinetry.
Root system	Deep taproot system that helps the tree access deep soil moisture.
Leaves	Large and compound with 9–17 leaflets/leaf. Leaves are alternate and pinnate, each leaflet about 5–12 cm long.
Flower type	The tree is monoecious, having separate male (staminate) and female (pistillate) flowers on the same tree.
Male flowers (Staminate)	Occur as catkins on the previous year's growth, clustered in groups of 2–8, producing pollen.
Female flowers (Pistillate)	Female flowers appear in clusters on current year's growth, usually few to several flowers in terminal clusters.
Flowering biology	Exhibits dichogamy, meaning male and female flowers mature at different times on the same tree, promoting cross-pollination. Dichogamy types include protandry (male flowers mature first) and protogyny (female flowers mature first).
Pollination	Wind pollinated (anemophilous), successful pollination requires planting a mix of protandrous and protogynous varieties to maximize nut set.
Nut clusters	Nuts usually form in clusters of 2–6.
Juvenile period	Trees generally take 5 to 10 years to start bearing fruits. Precocity varies with cultivar and cultural practices.

diseases and abiotic stress.

Propagation, planting, and orchard management

Propagation of pecan is generally carried out by 'patch budding', which ensures true-to-type plants with desirable nut and tree characteristics. Scion wood should be collected in spring before

bud swelling, and budding is undertaken during June or July on seedling rootstocks. Nursery raised saplings are transplanted into the field during December–January in Himachal Pradesh when soil moisture is adequate and the weather is cool. Since pecan trees become very large, they must be planted at a spacing of at least 8–10 m to allow



Bearing habit of pecan nut



Pecan nut seed enclosed in husk

healthy crown development.

In the orchard, trees must be trained under the 'central leader system', in which a single main trunk is maintained with spirally placed branches at regular intervals. The lowest branch is kept about one meter above ground, while upper branches are spaced roughly 30 cm apart. This system ensures good light penetration and durable tree structure. Heavy pruning is generally discouraged as it results in excess vegetative growth without improving nut yield. Instead, only

diseased, broken, or dead branches are removed periodically.

Irrigation, intercropping, and weed control

Pecan is more water demanding compared to other nut trees, especially during nut development. Irrigation is therefore essential during dry spells. Basin irrigation can be adopted initially, but farmers are encouraged to use sprinklers or drip systems that save water and improve nut quality and oil content.

Since young orchards take several years to bear economic nut

crops, farmers can intercrop with legumes like cowpea, soybean, and pulses, or vegetables like peas, tomato, and beans. Such intercropping not only provides additional interim income but also improves soil organic matter and prevents erosion on hill slopes. Weed control is necessary to reduce competition, for which farmers may use mulching with dry grass around basins. In larger orchards, pre-emergence herbicide simazine and paraquat spot sprays may be used carefully as recommended by specialists.

Harvesting and storage

Pecan harvesting in Himachal generally begins from the first week of November when husk turn brown and split open. Hence, farmers manually collect fallen nuts or use mechanical shakers for large orchards. Due to high oil content, pecans are prone to rancidity if stored improperly. Freshly harvested nuts must be dried to a safe moisture level and stored at cool temperatures of 1–5°C with 75–80% relative humidity. At room temperature (21°C), unshelled nuts remain acceptable for about four months, but under refrigerated storage they can last nearly two years. Proper storage is essential for farmers who want to sell during off-season at premium prices.

SUMMARY

Pecan is an underutilised but highly valuable nut crop that holds extraordinary potential for hill farmers in Himachal Pradesh. Pecans provide rich nutrition, health benefits, and high consumer appeal. Despite being introduced in India nearly 90 years ago, cultivation remains limited. Yet, Himachal Pradesh offers soil and climate environments suited for pecan orchards. Local farmers can establish orchards by following proper nursery production, planting at appropriate spacing, training under central leader system, irrigating regularly, intercrops during juvenile years, and managing weeds, pests, and diseases. Careful selection of varieties to encourage

Table 2. Recommended pecan varieties for Himachal Pradesh: Flowering types and cultivation advice

Variety group	Description	Examples of varieties	Recommendation for Himachal growers
Protandrous (Early pollen shedding)	Male flowers release pollen first. These varieties shed pollen before female flowers are receptive.	Desirable, Western, Wichita, Forket	Used in combination with protogynous varieties for best nut set.
Protogynous (Late pollen shedding)	Female flowers mature first. Female flowers are receptive before male flowers release pollen.	Pawnee, Caddo, Cheyenne, Cape Fear, Sioux	Must be planted alongside protandrous varieties for successful pollination and nut production.
Adaptability	Several varieties have shown good adaptation to mid-hill Himalayan conditions with good management.	Mahan, Mohawk, Caddo (also used in Himalayas)	Farmers should source scion wood from local horticulture departments and avoid planting single varieties alone. Mixed plantings ensure cross-pollination and higher yields.
Yield potential	Varies among varieties, but with good orchard care, these cultivars can produce high-quality nuts.	All listed above	Choose recommended varieties based on local advice and ensure proper spacing and care for maximum production.

Table 3. IPM practices for pecan

Crop stage	Major pest / Problem	Symptoms seen by farmers	IPM practices
Vegetative growth	Aphids, mites	Curling of leaves, sticky substance, black fungus	Encourage ladybird beetles, spray neem oil 3 mL if infestation increases
Leaf development	Caterpillars, leaf feeders	Holes in leaves, reduced leaf area	Hand-pick caterpillars, use light traps, spray neem-based biopesticide
Flowering stage	Thrips	Dry flowers, poor fruit set	Maintain orchard sanitation, avoid excess nitrogen, spray neem extract
Nut formation	Nut borer, stink bugs	Shriveled or damaged nuts	Collect and destroy affected nuts, install pheromone traps, bird perches
Throughout season	Diseases due to humidity	Leaf spots, poor tree health	Proper pruning for air flow, avoid overcrowding, spray bordeaux mixture if needed
General practice	Pest buildup	Repeated pest attack every year	Mixed cropping (During the first 3–4 years, farmers can grow pea, French bean, garlic or clover between pecan rows to earn extra income, improve soil health, and break the disease and pest cycle naturally), regular monitoring, balanced fertiliser use

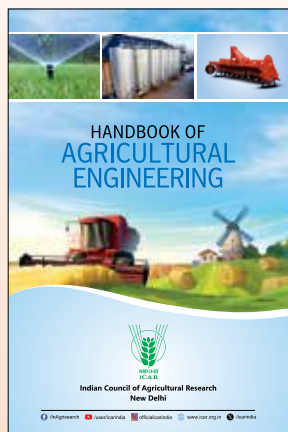
cross pollination and adoption of integrated pest management practices can increase yields and prevent losses. Above all, market price trends highlight the profitability of this nut, with farm gate values far exceeding traditional crops and potential returns reaching several lakh rupees per hectare annually. Pecans also contribute to long term sustainability by offering

valuable timber value alongside nuts, giving farmers a multipurpose asset. If promoted thoughtfully with research and extension support, pecan can become the next horticultural success story after apple and walnut in Himachal Pradesh, offering farmers higher incomes, secure livelihoods, and contributing to India’s growing dry fruit market. Overall, pecan nut

cultivation offers Himachal growers a long-term, high-value alternative that can generate greater economic returns than many traditional fruit crops under same agro-climatic conditions.

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