

Pecan: A potential fruit crop for Indian Himalayas

Globally, in the last decade, production of nut fruit crops have grown at a steady pace reaching ~5.4 million metric tonnes in 2022-23 according to International Nut and Dried Fruit Council (INC). United States of America was the top tree nut producer with 40% share, whereas India contributed only 3.5%. Pecan nut contributed 3% of the total tree nut production and in the last half decade, pecan growing trends displayed significant linear increments of 16,465 MT/year. In terms of estimated global tree nut consumption in 2021, almonds (31%) and walnuts (21%) accounted for half the total, while pecans made up 3%. Supply value of tree nut crops increased over the previous 10 years including pecans from \$0.92 billion in 2012-13 to 2.05 billion in 2022-23.

WORLD pecan production was estimated at 154,266 metric tonnes in 2022-23 with 9% increase from 2021-22. Production was led by Mexico (44%) followed by the USA (40%) and South Africa accounted for 10%. Globally, a record of 88,565 metric tonnes of shelled pecans was traded in 2021. Mexico and the USA remain as the top world pecan suppliers, accounting for virtually 99% of the world exports. India imports ~95% of pecan nuts to meet the demand of its rural as well as urban population. According to the New Mexico Department of Agriculture, India imported ~30% of pecan nuts of total tree nuts from the United States of America worth value \$544,761 (2018-19).

Production of fruits shoulders a larger prominence in hills of Himalayas. People owing to nutritional security prefer natural fruits produced from woody perennials. Pecans are rich in micronutrients, have phenolic compounds and its consumption is beneficial to health. In recent days, horticultural produce has opened new doors for income. However, technical know-how of management practices, viz. soil, irrigation, etc. is imperative for fruit crops cultivation. Pecans provide long-term returns starting production from eighth year with optimum production from fifteenth year. Hence, the extension of pecan nut cultivation technique is imperative for successful production management. The sapling's production and management and input supply for the establishment of orchards is very essential for its expansion.

Nutraceutical and nutritional properties

The nuts of pecan and other parts such as leaves, bark, etc. have several nutraceuticals and pharmaceutical properties and helps in treatment of numerous illness, viz. cardiovascular disease, improve digestive system, anti-inflammatory, bone and teeth, weight loss, blood

pressure, improve immune system, helps in skin problems, anti-ageing, reduce hair loss and anti-cancerous. The nutritional value of nut is given in Table 1.

Plant description

The pecan [*Carya illinoensis* (Wangenh.) K. Koch] is native to North America, a member of Juglandaceae family. It was introduced in India around 1930 in Himachal Pradesh. It grows well in fertile, profound and well-drained soils. It is deciduous in nature, leaves are alternate, in length up to 45 cm, and composed of up to

Table 1. Nutrients and their nutritional value in 100 g nut of pecan

Nutrient	Nutrient value
Energy	691 Kcal
Carbohydrate	13.86 g
Protein	9.17 g
Fat	71.9 g
Cholesterol	0 mg
Dietary fiber	9.6 g
Vitamin A	56 IU
Vitamin E	24.44 mg
Potassium	410 mg
Calcium	70 mg
Magnesium	121 mg
Phosphorus	277 mg
Zinc	4.53 mg
Iron	2.53 mg

Source: USDA National Nutrient database

15 leaflets. Pecan is a monoecious plant, the male flowers 'catkins' appear on the shoots of the last season. The female flowers appear towards the end of shoots of recent season. The pecan is a large deciduous tree, reaching a height up to 20 m, crown up to 15 m diameter and circumference of trunk of ~2 m.

The pecans can produce nuts that have commercial value up to ~100 years. The growth is limited by drought, excessive moisture and lower soil temperature.

Origin and geographical distribution

Pecan is believed to be originated from United States of America. Globally, the United States and Mexico are the major producers of pecan nuts, besides Israel, Brazil, Peru, Australia, Argentina, South Africa, China and India.

Cultivation in India

The pecans are cultivated in Uttarakhand, Jammu & Kashmir and Himachal Pradesh at elevations ranging from 1000-2000 m.

Climate

The pecan adopted well in humid to dry conditions and during the vegetative growth, the required temperature is 24-30°C. For its optimal development, there should be very little variation between the day and night temperatures. The plants overcome the dormancy if temperature is less than 7.2°C in the winter season. The pecans are frost tolerant and require sufficient light for proper growth and quality yield of nuts. The water deficit can create a situation of nut abortion; therefore, sufficient water supply needs to be ensured in the pecan orchard.

Soil

Deep, fertile, rich in organic matter, well-drained, well-aerated soil having good water holding capacity is suitable for pecan nut cultivation and such condition facilitates better root growth and distribution. The pecan trees are sensitive to saline and poorly drained soil that causes stress in its roots contributing to reduced production and even mortality of plants.



Plant spacing

The spacing of plants and rows are key for proper orchard management, pollination, pruning, and thinning. Plant-to-plant and row-to-row space of 6 m × 6 m to 10 m × 10 m results in 278 to 100 trees/ha, respectively is optimal recommended spacing for plant growth. Pecans are bare root planted when they are dormant during January to March. Before planting, pecan roots should be properly hydrated and protection is required from wind and freezing temperature. Pecan planting is done at the same depth or little more compared to the nursery. Roots are pruned if there is higher length of tap root and more side roots as well as top of the plant for balancing the shortened root system.

Pollination

The pecan is a monoecious tree, having separate male and female flowers on the same plant. It has dichogamy, which means that pollen release and stigma receptivity timings may be different. This mechanism helps preventing self-pollination and favours cross-pollination, which is better for nut size and kernel yield. Dichogamy in pecan is influenced by locality, time, plant vigour and age. High humidity and temperature in spring season favours early maturation of male flowers, i.e. 'protandrous' whereas, dry and cold springs favours early female flowers maturation i.e., 'protogynous'. There is scarcity of suitable pollinisers; however, Mohawk, Mahan and Stuart varieties can act as pollinisers. The pollination in pecan is anemophilous type which means larger spacing may reduce fruiting due to poor pollination. Hence, pollination is very important for higher production.

Cultivars

The quality and suitable cultivars for Indian Himalayas are Mahan, Busseron, Cheyenne, Desire, Caddo, Cape Fear, Forkert, Kiowa, Oconee, Houma, Wichita, Western, Tejas, Pawnee, Sioux, and Mohawk. These cultivars are being maintained by Indian Council of Agricultural Research- National Bureau of Plant Genetic Resources, Regional Station, Shimla. Both cultivars protandrous and protogynous should be selected with 15% variety as pollinisers which are uniformly distributed in the orchard





for better production and profitability. For example, every fifth tree should be polliniser.

Propagation

The propagation of pecan can be done through seeds and vegetative (cuttings, grafting and budding) methods. Seedlings can be prepared bare root and in containers. Seeds are stratified in moist sand for 70-80 days at low temperature (7°C) to improve germination and seedling development. Bare root plants can be transplanted in the containers or may be directly planted in the field. From seeds, rootstocks are obtained for grafting.

Nutrition management

The pit size of 1 m × 1 m × 1 m is dug out and filled with mixture of 12 cm top soil and farmyard manure in 1:1 ratio, besides 400-500 g single superphosphate and 40-50 g chlorpyrifos are also added per pit. The root system of pecan tree has symbiosis with mycorrhizae that increases root exploration area and helps optimize N, P, K, Ca, Mg, Zn, and Cu absorption from soil leading to increased production. Zinc deficiency in pecan trees affects development of chloroplast, reduces nut weight, decreases fruit development, maturation and production. It has been reported that Zn foliar concentration below 50 mg per kg creates deficiency symptoms. Zinc and Mn can be applied in the form of foliar application. The farmyard manure of 20-25 kg and 450-500 g N: P: K mixture (2:1:1) per tree should be applied starting from pecan bearing stage during spring season.

Training and pruning

The training and pruning are paramount in pecan to have a proper shape and size. Pecan plants are generally trained on central leader keeping the lowest branch at least at 1 m height and thereafter spirally arranged one after another on central leader. Light pruning which is also majorly removal of dead, damaged and overcrowded branches is recommended in pecan.

Irrigation

Pecan tree requires proper irrigation to obtain good yield, nut weight, size, oil content, size and quality nuts.

Irrigation can be provided by any means however; drip irrigation is better.

Agroforestry (Intercropping)

The pecan trees under space between plants and rows can be utilised by growing agricultural/ horticultural crops. Crops such as maize, pea, lentil, wheat, soybean, finger millet, turmeric crops and vegetables are suitable as intercrop under pecan orchards.

Carbon sequestration

Pecan trees can sequester of 46.5 t carbon/ha and contribute litter fall of 8.4 t/ha to the soil at 22-year age. This litter fall enhances the structural, chemical and biological properties of soil leading to improvement in soil quality.

Diseases

The major disease is scab that is caused by the fungus *Fusicladium effusum* (G. Winter). It affects leaves, petioles and fruits. Rainfall, high humidity and temperatures above 21°C enhance scab occurrence in pecan trees. Hence, preventive measures like adequate spacing, planting in full sunlight incidence and well-drained area must be ensured. No major insect pest infestation has been reported in India.

Harvesting and yield

Nuts of the pecan are harvested in the month of October-November in Himalayas. The right time of harvesting for better quality is when the pods turn brown in colour, open and splits off, nuts are separated from shells. Early harvesting should be avoided. Nuts are harvested by shaking the trees however; manual harvesting is preferred with bamboo sticks. The harvested nuts are properly dried and stored. A matured pecan tree yields 15-20 kg nuts with optimum management. It can produce up to 30-35 kg/tree.

Marketing

Grading of pecan nuts based on size and shape should be done after harvesting. Usually marketing season of pecan nuts is winter (November to March) which can be extended through storage like cold storage. For storage,

nuts are dried to 4% kernel moisture and relative humidity of 75-80% is maintained. Farmers have options for selling pecans in the nuts form and shelled pecans. They can sell pecan directly to the consumers using online platforms like amazons and can sell to big markets, supermarkets etc.

Uses

The pecan kernels can be used in value-added products like cakes, pies, ice-creams, candies, baked goods, etc., by bakers and confectioners. The shell of pecan nuts can be used in making particleboard, as a mulch etc. The wood of pecan is useful for the furniture industry.

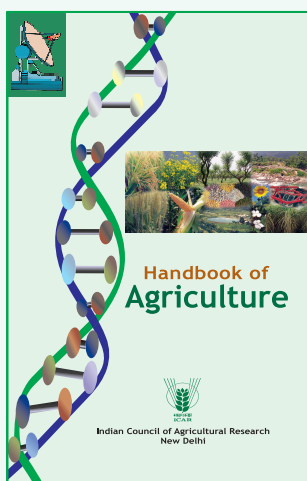
It has only one time investment, later on it can provide sustainable economic yield for more than 60-

70 years. Considering the economic value of pecan, besides health benefits, pecan is a paramount fruit crop of the Himalayas. It will help in providing livelihood security and income improvement to the people of the hills. Besides, it traps carbon in plant body and helps in environmental security. Careful selection of cultivars, proper spacing, adequate sunlight, selecting compatible varieties for pollination, leaf retention and nutrient management are important management practices for ensuring a profitable commercial pecan production.

For further interaction, please write to:

Dr Ram Prakash Yadav, ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora, Uttarakhand 263 601.
*Corresponding author: rams34052@gmail.com

Handbook of Agriculture



The Handbook of Agriculture is one of the most popular publication of the ICAR with a wider readership. The present edition presents science-led developments in Indian agriculture, the ongoing research efforts at the national level and with some ideas on the shape of future agriculture. While information in some chapters such as Soil and water, Land utilization, field and forage crops has been updated with latest developments, many new topics such as the Environment, agrobiodiversity, Resource conservation technologies, IPM, Pesticides residues, Seed production technologies, Energy in agriculture, informatics, Biotechnology, Intellectual Property Rights, Agricultural marketing and trading and Indigenous Technical Knowledge have been included in the present edition. For those who take intelligent interest in agriculture – and their number is increasing fast – the present edition would serve as a useful book.

TECHNICAL SPECIFICATIONS

Size	:	Royal Octavo (16 cm x 24 cm)
No. of pages	:	i-xii + 1620
Price	:	₹ 2000
Postage	:	₹ 200
ISBN No.	:	978-81-7164-096-6

For obtaining copies:

Business Manager

Directorate of Knowledge Management in Agriculture
Krishi Anusandhan Bhavan-I, Pusa, New Delhi 110 012
Tel: 011-25843657, Fax: 09-11-25841282; E-mail: bmicar@gmail.com

SCAN QR Code to
Purchase Online

