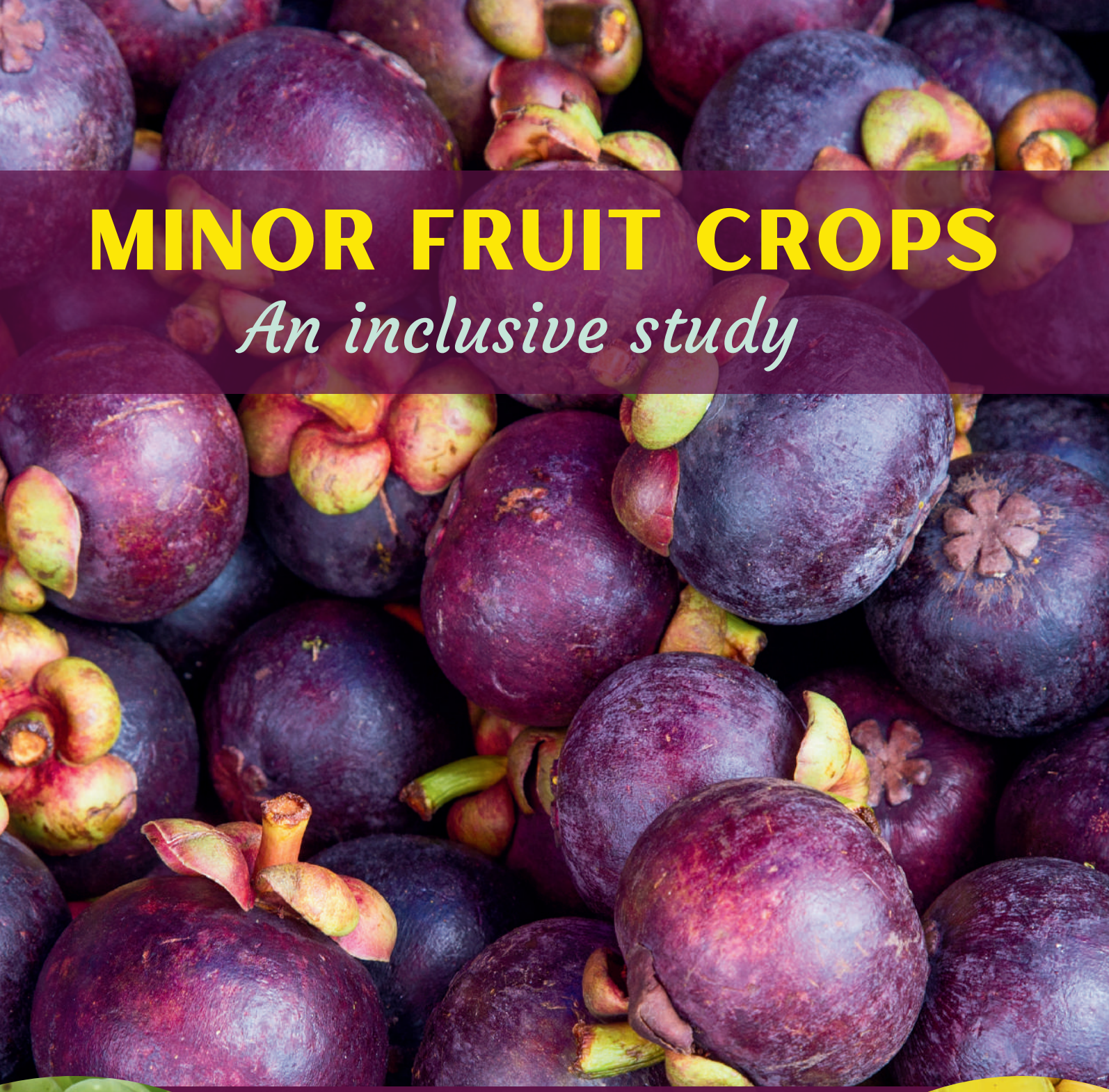
MINOR FRUIT CROPS

An inclusive study



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Chapter - 13

Cactus Pear

*Prarthana Diya Barman, V. Rajashree, F.K. Bauri and T.P. Rathour**

Prickly pear (*Opuntia ficus* India (L) Mill.) is also known as Cactus fig or Tuna. It is a member of the Cactaceae family. The genus Opuntia has about 300 species, 12 of which are produced for fruits, vegetables, and fodder.

As a succulent xerophytic plant, it is well adapted to the world's water-stressed arid zones. It takes little energy to produce food and fodder for humans and cattle. It is a plant that thrives in semi-arid and dry environments. It is found in India as a wild and underutilized fruit. However, it is a Mexican National Crop. Commercial cultivation of the cactus pear occurs in the United States, Israel, Chile, Peru, Brazil, Bolivia, Argentina, Italy, Tunisia, the Middle East, and South Africa. It is a xerophytic plant with spiny or spineless leaves (Krishna *et al*., 2019).

It has a fibrous, shallow root system. When areoles come into touch with soil, roots form. Cladodes are thick succulent stems on the plants. These cladodes or cactus stems, feature multiple areoles that operate similarly to meristematic buds. With time, the buds grow into new cladodes, fruits (areal parts), and roots (subterranean parts) (Wessals, 1998). The thornless cactus pear has been brought from Texas, the United States, and Israel.

Morphology and botanical description

Cactus plants are distinguished by their flattened stems, nopales, cladodes, and edible fruits. Glochids, primitive leaves, and pale-covered seeds characterise them. Cactus roots are complex, having tap, rain root, root spurs, and areole-formed roots. The tap root system enters deep down horizontally, whereas rain roots appear to take water within hours following light rain. Sessile, actinomorphic, hermaphrodite, and solitary cactus blooms are pollinated by nocturnal insects and tiny mammals. Tuna berries are round, elongated, fleshy berries with a constant quantity of firm seeds. Cactus cladodes feature huge and tiny spines called glochids that easily puncture the plant's epidermis.

Climate and soil

Cactus pear production necessitates sunny, warm summers and calm, dry winters with temperatures no lower than -5°C in spring and early summer and yearly precipitation of 300-600 mm. Cactus pears are drought-tolerant and flourish in dry and semi-arid environments with sandy soils. They may grow on alkaline, heavy, gravelly, and rocky soils as well as acidic soils. The ideal temperature range for nocturnal CO2 uptake is 25/15°C Day/night. Temperatures that are too high or too low result in poor plant development and low crop value. High temperatures during fruit development change the structure of the fruit and reduce the third stage of growth, resulting in early ripening with undersized fruits, poor firmness, and sugar content. High temperatures during fruit growth also make the fruit more sensitive to low temperatures during post-harvest storage, resulting in shorter storage times.

Varieties

There are no indigenously known cactus pear varieties. However, in 1987, 33 Opuntia clones were introduced to the Nimbkar Agricultural Research Institute in Phalton, India, as part of an Indo-US joint research program on Opuntia. All of these clones thrived in the semi-arid agroclimatic of western Maharashtra, and some even produced fruits (Meghwal and Singh 2016). Karnal's Central Soil Salinity Research Institute got five fruits, pasture, and weed species in 1991 from Dr. Peter Felker's collection of vegetable clones in Texas, USA.

In January 1997, 51 more Opuntia clones from Texas A&M University-Kingsville were introduced at the ICARCIAH, Bikaner. Genotype 1269 outperformed the others in terms of survival and cladode production.

Propagation

Vegetative propagation: During the months of February-April and July-September, cactus pear is vegetatively propagated by mature cladodes 5-6 months old. It may be propagated all year in a greenhouse. Cladodes should be cured after being removed from the mother plant. Keep the detached cladodes in the shade for about two weeks to allow appropriate healing and dehydration for improved conservation and establishment in the field. Cactus pear plants produced vegetatively using cladodes are susceptible to foot rot disease, which causes significant mortality in field plantations. As a result, tissue culture provides a viable alternative option for large-scale fast multiplication of healthy, pathogen-free plants.

Micro-propagation: The methodology was successfully established at ICAR-CIAH (Singh *et al*. 2006 and 2009), Bikaner for bulk multiplication of thorn-less, vegetable type elite genotype (acquired under germplasm collecting programs) by tissue culture employing single bud explant.

A single bud segment from a physiologically developed cladode was employed for culture initiation. MS media supplemented with 30 g sucrose, 8 g agar, and 2 mg BA+ 0.1 mg NAA per litre produced the most numerous shoots (8 shoots/explant). Multiple shoot clumps are then cultured in a medium devoid of plant growth regulators for shoot elongation. The elongated shoots were completely rooted in vitro using medium containing IBA or NAA.

Planting

Cactus may be planted in the field between July and September, and between February and April. However, it may be planted all year in a greenhouse. Plant survival was shown to be highest in fields planted between July and September.

Water management

Because cactus pear is water-sensitive, optimal irrigation should be supplied throughout the early phases of development. Cactus plants do not require immediate irrigation after planting. After 2-3 days after planting, light watering should be applied, followed by irrigation every 10-15 days over the next year. For maximum output, a fully established crop requires just little watering.

There is no need for irrigation in locations where summer rains are plentiful since cactus has the highest water consumption and rain use efficiency of any drought-tolerant crop. Except during the monsoon season, monthly irrigation was shown to be advantageous to cladode growth and development.

Nutrient management

Cactus pears have minimal nutrient needs, yet shortages can result in severe plant health and economic production losses. The use of manures and fertilisers in the winter is efficient in producing new cladodes and fruits. Under greenhouse circumstances, applying NPK grade 3-5 gramme per litre is excellent for new cladode sprouting. Organic manures enhance soil structure, nutritional content, and water retention. For appropriate growth, Kauthale *et al*. (2017) propose applying 5 MT thoroughly decomposed Farm Yard Manure and 60:30:30 kg NPK per hectare. 20 kg nitrogen boosts post-harvest sprouting for cladode production.

Harvesting

Bring to the location a pair of tongs, a broomstick or picker, a collecting container, and gloves. Traditional agricultural implements known as ***apulia*** are employed, but they are not as common. Put on the gloves and make sure your hands and arms are completely covered. Tongs work well for little cactus, while a fruit picker works best for bigger ones. If you're using a broomstick, place it beside and

beneath the fruits and gently tap them into it. If any of them miss the target and fall to the ground, pick them up with the tongs. The container may be left on the ground while the tunas are picked and placed inside using a picker. If one is available, this is usually a more successful strategy. It's advisable to leave them until next time if they're resistant to being selected. Bring the load to your preferred processing area, which is usually a gardening bench, patio, or hard kitchen work surface.

Use the torch to burn off any leftover spines or glochids at the work location, preparing them for usage or storage. Wear gloves and hold each tuna with tongs until you're finished with this step.

Yield

Cactus pear fruit output is affected by factors such as climatic conditions, cultivar, plant age, and management approaches. After 4-5 years, commercial production is attained, with better cultivars giving 10-12 MT/ha fruits and 10-150 MT/ha fodder every year. For marketing, fruits are graded and packed in clearly branded boxes. High-density planting schemes promote vegetative rather than reproductive growth, with orchards with 300-400 plants per hectare and 50-60 kg fruits per plant per year producing the maximum yields in Italy. Plant alternating bearing behavior can be caused by competition between fruit and cladode development, as well as a decrease in new cladodes following SFR (Kumar, *et al*., 2018).

Storage

Freshly picked fruits can be kept on the kitchen counter for a few days, softening somewhat at room temperature. They may be kept in the refrigerator for one to two weeks unpeeled. Peeled fruits and processed pulp should be consumed within a few days or frozen to avoid spoiling. A resealable plastic bag may be used to store the pulp in the freezer, or an ice cube tray can be used to split the pulp into parts for usage in smaller quantities. To keep the tray fresh, fill each part and then wrap it in a gallon-size storage bag. Frozen pulp normally lasts six to twelve months, which is fantastic since it gives you plenty of time to experiment (Spicer, 2022)

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