

GROWING, COMMERCIALIZING, AND MARKETING CACTUS LEAVES IN MEXICO

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History of Nopal Utilization in Mexico

There is evidence of nopal utilization in Mexico 9000 years ago (7000 B.C.) in archaeological excavations at Tehuacan, Puebla (140 miles southeast of Mexico City). In the northern State of Tamaulipas, seed trails, cactus pears, and cactus leaves have been found. There is an accepted idea that nopales were an important part of the former habitants diet.

The Aztecs, who built the most important culture in ancient times of Mexico until the Spanish arrived and became established in 1521, consumed a large amount of nopales for food and medicinal purposes. The Aztec society built their city where they found an eagle eating a snake over a nopal on a rock in the center of Lake Tenochtitlan. This image is represented in the Mexican flag.

The cochineal (Dactilopus coccus Costa.) is a parasitic insect on nopales that produces a carmine tint. Cochineal dyes have been used since the Toltec culture (1000 A.C.) for colorful textiles, sculptures, buildings, paints, and writing codexes. In the colonial period (1521-1810), cochineal tint production was the third most important item of export value to New Spain, after gold and silver. The areas of production were in the present states of Oaxaca, Puebla, and Tlaxcala.

During successive historical periods (independence period 1810-1850; reform period 1850-1880; Porfirismo period 1880-1910; revolution period 1910-1920, and at the present time) nopal products have been used only for food and medical purposes.

Production Systems of Nopales in Mexico for Cactus Leaves

There are three principal systems of cactus leaf production, which will be discussed below.

Cactus Leaf Production from Wild Prickly Pear

The tender leaves (nopalitos) are collected in the central region of Mexico and in some northern states. Several wild species are collected in spring to late summer. The main use is for family consumption, not for sale. An exception occurs in San Luis Potosi (400 miles north of Mexico City) where cactus leaves of the species Opuntia robusta (nopal tapon) are harvested and sold from March to June. The plants are harvested within an 80-mile radius of San Luis Potosi City. The cactus leaves have dimensions of 3.2 to 4.7 inches. After cutting, leaves are cleaned (thorns removed), weighed, and carried in plastic sacks to one of the five industries in San Luis Potosi City where the leaves are processed and canned. The exportation of this product is its principal purpose. Annual production is from 3000 to 4000 metric tons (6,600,000 to 8,800,000 pounds).

Cactus Leaves in Family Orchards

In family orchards around country homes, nopales frequently form a living fence around the property. The tender cactus leaves are collected for consumption in the home but sometimes are sold nearby in small quantities. An important consideration in these home orchards is genetic variation and long history of selection by the families. Genetic material in family orchards was the source of most of the commercial varieties.

Cultivated Orchards

Two different production systems are used for cultivated orchards, traditional and microtunnel.

Traditional System

In this system, the nopal is planted in rows spaced 40 to 60 inches apart and leaves are spaced from 10 to 20 inches apart in the row. The plants usually grow to 40 to 60 inches tall. With this spacing, the rows form a fence with densities from 6800 to 18,000 plants per acre at an average of 7200 plants per acre.

Microtunnel System

Intensive agronomic techniques using microtunnels for producing cactus leaves were developed in Chapingo, Mexico, in the 1960s. With these techniques it is possible to have high yields in winter when the temperature goes down in all temperate-climate zones.

Planting beds are typically 47 to 78 inches wide, 40 to 60 inches between beds, and 120 to 140 feet long. Mother plants must be oriented to obtain maximum sun energy (being careful in desert areas to avoid burning the leaves). The cladodes are planted very close (1.5 to 2.0 inches) with the distance between the rows of mother plants of 8 to 12 inches for a density of 54,500 to 72,600 plants per acre. In this production system, it is only possible to harvest the tender cactus leaves from the mother plant or from the cladodes directly attached to the mother cladode. In winter, a plastic cover is necessary to avoid frost damage and to obtain production when prices are high.

Techniques for Growing Nopales to Obtain Cactus Leaves

Land Preparation

First, the field must be clean, without shrubs or any other plants. Most commonly, the field is first worked with a tractor and then several times with animals to make the soil soft and easy to plant. However, there are fields on the hills where is not possible to use a tractor or animals. In this case the task is completed with a pickax. Some farmers are more sophisticated and use rotocultivators to produce a very, very soft soil. In desert areas, or other areas where irrigation is necessary, the field is leveled. The main objective of the land preparation in all cases is to have the soil as soft as possible because it is very important to have the roots grow very well in the first stage of growth.

Planting Conformation

Normally, farmers use a metric tape to establish lines in the traditional system and to lay out beds for microtunnels. Sometimes cords and wood pickets are used. The basic idea is to have the nopales properly oriented; the nopal faces must be oriented east to west. With this orientation, large root systems develop and sunburning is avoided.

In almost all of the systems and production regions, the mother plant is set in a hole at a depth of approximately 1/3 the height of the leaf. Orientation of the leaves relative to the sun is very important for best results.

Varieties

Although many varieties exist in family orchards and in wild prickly pears, only principal varieties used in commercial plantations will be discussed here.

Milpa Alta

This variety, whose scientific name is Opuntia ficus-indica, is the most important in Mexico because of the large cultivated area and the quantities harvested. It is cultivated in Milpa Alta, D.F. (40 miles south of downtown Mexico City) and in Tlalnepantla, Morelos (80 miles south of Mexico City).

Copena V1

This variety, created in the 1960s by Facundo Barrientos, is thornless and was intended for cattle feed. It is dark green, juicy, has good taste, and is not sour. It grows in the Central Mexican states of Hidalgo, Mexico State, Guanajuato, and the northern state of Baja California.

Copena F1

This variety, which is similar to Copena V1, was created by Facundo Barrientos during the same period as Copena V1 and also was intended for cattle forage. In addition to being thornless, this variety is highly productive, very low in mucilage, and is good tasting, making it suitable for human consumption. It is cultivated in central Mexico states of Tlaxcala, Puebla, and Mexico State, and in Baja, California.

Black Var. and White Var.

These varieties grow near Uruapan, Michoacan (350 miles west of Mexico City). The cactus leaves are marketed in this area, Guadalajara, and even in Tijuana in winter.

Tamazuchale

This variety, which grows in the mountains of Tamazuchale, belongs to the Nopalea genus and has long leaves, few thorns, and a dense cuticle. The Texas A&I University 1308 nopalito cactus is of this type.

Other Varieties

There are other cultivated varieties, but they have only local significance: Moradilla May. in the Texcoco Valley (25 miles northeast of Mexico City), Atlixco May. in Puebla, Polotitlan May. in the northern part of Mexico Valley. These varieties have not been evaluated.

Fertilization

In nopalito production, farmers normally use from 45 to 90 metric tons per acre of dry cattle manure for fertilizer. Inorganic fertilizers are applied as 100 to 200 pounds of nitrogen and 100 to 150 pounds of phosphorus per acre. In traditional plantings, cattle manure is applied on nonplanted areas (between the rows) 4 to 6 inches in thickness. Usually, manure is applied at planting, then every two or three years. In intensive systems, manure is put on every year at the beginning of the productive season.

Irrigation

Irrigation is used in northern desert areas of Baja, California but not in other production areas.

For the intensive microtunnel system at Chapingo, Mexico (annual rainfall 600 mm), 100 mm of water per month is applied when there is no rain. With irrigation, yields increase 10% to 25%.

Disease Control

There is a great variety of disease problems in nopalito production, but most of the time, they are not serious. The exception is in Tlalnepantla, Morelos where high humidity and lack of a frost period is conducive to serious problems with diseases. Because of these disease conditions, farmers apply pesticides frequently, but without proper technical knowledge.

This lack of knowledge leads to incorrect selection of pesticides or fungicides. Sometimes the chemical product is forbidden by the United States Food and Drug Administration (FDA) or Mexican regulations; therefore, it is not possible to export the tender cactus, whether canned or fresh.

For all farmers and in all productive regions a virus disease known as "swelling of the cladode" is a serious problem. There is no prevention for this problem, which adversely affects cactus pear production.

Weed Control

For the high plant densities in cultivated systems (traditional and intensives), only manual labor is practical for weed control. Notwithstanding, sometimes herbicide application is necessary, but care must be taken not to spray the cactus leaves. If used every year, manure is effective in weed control.

Frost-Damage Prevention

In traditional systems, no one uses burners to increase temperature and avoid frost damage. With microtunnels, the plastic cover (4.5 feet above the soil surface) increases the temperature inside the tunnel to control frost damage. Therefore, it is possible to have tender cactus leaves in winter when overall production is low and prices are high.

Pruning

In traditional systems, pruning for plant conformation is necessary. Pruning is important in preventing plant overgrowth and in preserving clear spaces between rows. In some regions, when the budding process is very rapid (in spring), and the prices come down, farmers cut off about half of the terminal leaves. This pruning controls budding and the plant accumulates nutrients in reserve for the late production (autumn and winter seasons) when prices rise again. Some farmers use pruning to stimulate production late in the season when prices are down.

Harvest

Cutting the tender leaves with a knife gives best results if the cut is exactly at the union of the leaves. Cutting to include a small piece of mother plant gives longer freshness to the tender cactus leaf, but this can damage the plant because it takes off the buds. Agronomical or economic consequences of this practice have not been evaluated.

When harvesting is by hand, the leaf is turned and pulled up. With this method, there is damage because the scar does not close as soon as necessary and the leaf dehydrates and becomes rotten. For exportation, the best method is use of the knife, taking a little piece of the mother plant.

Packing

In Mexico, there are several methods of packing cactus leaves for distribution to markets.

Packs

Packs are utilized by the growers of Milpa Alta, D.F. and Tlalnepantla Morelos whose product goes to the Mexico City wholesale market. The packs consist of cylinders 5.6 feet tall and 2.3 to 2.6 feet in diameter. Each cylinder contains approximately 3000 cactus leaves and weighs 550 to 660 pounds.

The cylindrical pack is constructed around a short, open iron form 1.6 foot in diameter. The form is put in the center of a large cloth on the ground. Fresh herbs (grasses) are put inside the form and cactus leaves are arranged in circles stacked on top of each other outside of the form. When the cylinder of cactus leaves reaches the top of the form, the form is pulled up and the packing procedure continues until the cylinder is 5.6 feet tall. Then, the form is removed and more herbs are put on top of the pack. A

second cloth is put over the pack and tied to the corners of the first cloth to enclose completely the cylinder of cactus leaves. The pack is very strong and allows transportation without serious damage to the cactus leaves.

'Colotes'

The tender cactus leaves are cut and carried out of the field in a special bucket called 'colotes', which are made of reed grass material. Sometimes colotes are used not only to carry the product out of the field, but to go to the market and offer the cactus leaves to customers. Colotes are used in Milpa Alta.

In a Heap

Some farmers in Milpa Alta carry cactus leaves on trucks (0.5 to 3.0 tons), without packing, to the local market.

Wooden Boxes

This packaging is used in Milpa Alta to transport the product to Mexico City, Monterrey, Tlaxcala, and Guadalajara. The package consists of a single box over which a second box without a bottom is placed. This "double box" is filled with cactus leaves, then plastic film is wrapped around the boxes to hold them together.

Pack-Cloth

The pack-cloth is used in San Luis Potosi and Zacatecas. Cactus leaves from these areas are used for industrial purposes, but must be cleaned to avoid contamination. Industrial buyers are thinking about giving workers plastic boxes to avoid contamination problems.

Removing Thorns

In Mexico, most housewives buy cactus leaves without thorns -- retailers usually clean thorns in the marketplace. The cactus leaves are sold by dozens (60 cents per dozen in July). In northern Mexico (Coahuila and Sonora), the product is cleaned and cut into small pieces. In Sonora, cactus leaves are cooked in water and offered to customers on large trays.

Supermarkets present cactus leaves in many ways: canned, with thorns, thornless; thornless and cut off, and eventually -- not yet a common presentation -- cooked in water with salt. Except for the latter and canned presentations, leaves are refrigerated.

Cactus Leaf Production Regions in Mexico

At present, about 22,000 acres are under cultivation in Mexico for tender cactus leaf production. Production areas are concentrated in Central Mexico. The cultivated areas by states are:

State	Cultivated Area (acres)
Distrito Federal	16,500
Morelos	660
Michoacan	440
Guanajuato	440
Nayarit	396
Sinaloa	330
Mexico State, Hidalgo, Tlaxcala, Puebla, Jalisco, Oaxaca, and Baja California	220
Aguascalientes, Durango, Zacatecas, Queretaro, and San Luis Potosi	110

Supply and Demand for Tender Cactus Leaves

Demand

We know that in central Mexico demand is constant all year except for considerable increases at Christmas and during Lent. In northern states and coastal regions consumption is low, except in some large border cities, such as Tijuana, where there are immigrants from central Mexico.

Supply

On the contrary, the supply of fresh cactus leaves has been constant all year around, except in winter when frost reduces production. This year, production was low in Milpa Alta; but there are two ways to avoid this restriction:

- Production in the frost-free regions of Tlalnepantla, Morelos and Uruapan, Michoacan.
- Intensive production in microtunnels. This system is beginning to increase in Milpa Alta, but there are only 33 acres in production under this system. Microtunnel production is beginning in other parts of central Mexico (Hidalgo and Queretaro).

Perspectives on Processing Nopalitos

Because of the large supply, some farmers have initiated processing of nopalitos with more or less success. The products obtained are discussed below.

As Food

In Mexico, the common way to preserve tender cactus leaves is in brine solution and, sometimes, pickling. Also jellies and dried leaves combined with sugar are produced.

For Mexican demand, tender cactus canned in brine or pickled does not hold great promise because the fresh product is available all year at low prices.

Medicinal Uses

It has been scientifically proved that nopal consumption reduces blood glucose levels in diabetics and has the same effect on cholesterol. For these effects, and considering the ancient uses of nopal as medicine, some firms make capsules of processed cactus leaves.

Cosmetics

Common products manufactured from cactus leaves are shampoos, rinse, soaps, and facial creams.

Our particular point of view about processing is that we don't see a big problem in the marketing strategies, regardless of whether the market is Mexican or exportation. However, the increased demand will have to result from professional and effective publicity, which is very expensive. Unfortunately, Mexican growers are not organized for such activity.

Exportation Trends

International Demand

Tender cactus leaves are restricted to Mexican food at present, thus the demand is limited to Mexico and to areas of the United States where there is a Mexican population. However, with publicity, some American firms are selling tender cactus leaves in small quantities to non-Mexican consumers. Some European and Asian countries are also consuming tender cactus as an exotic food.

International Supply

Tender cactus leaves are cultivated outside Mexico in California and Texas. However, the Texas and California varieties used are of the genus Nopalea, which have a brilliant green color, are thornless, and have a thick cuticle. Most consumers prefer Opuntia varieties.

Different Forms of Presentation for Export

Sometimes cactus leaves are exported with thorns, but this makes them very difficult to sell. Some wholesalers in Los Angeles clean the cactus leaves in Tijuana, pack them in one-pound polyethylene sacks (entire or cut leaves) and distribute them under refrigeration.

Mexican traders (there are no organized farmers in direct trade for exportation) export tender cactus leaves to American cities with large Mexican populations, such as Los Angeles, Chicago, and some cities in Texas. The commercial name is "cactus leaves" for fresh nopal and "tender cactus" when it is canned.

Promotional Requirements

We think that a promotional strategy is necessary to increase cactus leaf exportation. This campaign must be well planned, professional, massive, and, therefore, very expensive. We believe that the first step is to look for the Mexican resident's attention -- to help Mexican farmers -- and, second, Anglo consumers. For the Mexicans living outside Mexico, the publicity must be based on medicinal as well as food characteristics.

Cattle Feed Possibilities

In all orchards for cactus leaf production there are many leaves in mature condition because pruning is necessary. Normally, this material is cut into pieces and incorporated into soil where it causes phytosanitary problems even if it is put off the field.

An alternative use is fodder for ruminants (cattle, goats, sheep). It is necessary to consider that nopal is a sprout that contains much water and is not a complete food source. Thus it is necessary to complement it with dry forage and other supplements to give cattle protein and energy. In well-balanced diets, nopal gives 60 percent of energy and zero protein.

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