



LIFE16-CCA IT 000011

Commercial plan Italy: Prickly pear (*Opuntia ficus-indica*)

Appendix to the Action C7-3



DESERT ADAPT, LIFE16-CCA IT 000011

2022



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Data Beneficiary

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This commercial plan is one in a range of similar documents. List of commercial plans available:

Spain	Italy	Portugal
L5/L6*: Aromatics, Jara (all uses, including oil), Honey . L7: Nuts (Pistachio), Tourism (Bulls & cows)	L1: Aromatics L2/11: Honey + beekeeping in general (selling/buying bee colonies & queens), Wild asperges, Pistachio L4: Sumac (<i>Rhus Coriaria</i>), Prickly pear (all products like Fibre, (frozen) juice, fruits etc).	L8: Tourism . L9: Carob tree . L10: Strawberry tree. Hunting (link with national hunting orgs, photo hunting options).

* L numbers are the landowners in Life Desert-Adapt project that sell these products.

1 Type of product or service

Prickly pear (*Opuntia ficus-indica*) is a member of the *Opuntia* family with includes about 250 species. *Opuntia* species are found from Patagonia to Alaska, but it is in the dry and warm regions of America that they are the most diversified. The species of *Opuntia* are difficult to differentiate, they are similar, have similar flowers and fruits, the same specie develops differently depending on climatic conditions. Besides that *Opuntia* easily hybridize!

Opuntia ficus indica and *Opuntia robusta* are native to Mexico. These two species were selected by humans for their edible "cladodes" (the 'leaves' of the plant) and their edible fruits.

The most widely used species nowadays (with many varieties) is *Opuntia ficus indica* and to a lesser extent *Opuntia robusta*, their cultivated varieties are often without large spines unlike "wild" species.

Opuntia were introduced (sometimes accidentally) in many countries with a hot or Mediterranean climate (Italy, Spain, South Africa, Australia) as ornamental, edible and medicinal plants, fodder or to make natural fences (hedges) because the majority of *Opuntia* carry formidable thorns.

Opuntia ficus-indica, is a plant that can reach (slowly) 3 to 4 meters in height. The plant grows best in light (sandy) and medium (loamy) soils and prefers well-drained soil. It cannot grow in the shade. It prefers dry soil and can tolerate drought. The plant can tolerates strong winds but not maritime exposure. The most characteristic part of opuntia is their leaves or "cladode" or "nopal". They are in fact flattened stems and not leaves, usually 10 to 40 cm long and 10 to 30 cm wide and 1 to 3 cm thick. They are connected to each other and can slowly form by lignification what looks like a trunk or a branch. These cladodes are always green and have many areoles (vegetative points at the base of tiny leaves) from which will grow a new cladode, one or more sharp spines, or a flower that will later give a fruit. Besides the thorns on the cladodes the fruits are also covered with fine needles (glochids) able to become permanently embedded in the skin. These are plants that defend themselves very well against herbivores!

Invasive.

In some countries *Opuntia* is declared an invasive and (too) resilient species. They are considered an unwelcome disturbance in areas where efforts are made to mimic a natural, unobstructed system. *Opuntia* grows very slowly but indeed does slowly 'invade' and becomes a wider bush throughout the roots. They do not spread through seeds. This invasive behaviours is easy to control by simply keeping the row or plants under control. Nevertheless, indeed, in a more natural environment with minimal human influence, it is not a good idea to introduce the plant.

The Prickly pear is a real multipurpose plant. It has many purposes!

Traditionally there are the following main uses:

- **Fresh vegetables (cladodes).** Traditionally the young cladodes of opuntia are used fresh in salad or after cooking in sweet dishes or with meat or vegetables.
- **Preserved cladodes.** After dehydration they can be canned (like green beans or spinach).
- **Powdered cladodes.** After dehydration the cladodes can be grinded into powder form as a dietary supplement.
- **Fruits.** The fruit of the opuntia can be eaten and sold.
- **Processed and preserved fruits.** Fruits can also be processed into many other things like any other fruits (jelly, syrup, jams, marmalade, juice etc). Fruits can also easily be frozen. Those interested in alcohol can use the fruit to make beer, wine, mampoer, or liqueurs.
- **Seeds & oil.** You can make oil from the seeds.
- **Fodder cladodes.** In large parts of the world *Opuntia* is grown for fodder and animal feed in general.

- **Fire breaker and natural fence plant.** Opuntia almost doesn't burn. The specie can be used as a fire lane, or fire buffer. Besides this it can be used as an natural fence.
- **Water battery cladodes.** In the Life project Desert Adapt project cladodes were used as a planting aid for young trees, plants and shrubs (of other species, not opuntia). After digging the planting hole 1 or 2 fresh cladodes were placed at the bottom of the hole. They take a long time (up to 6-12 months) to become dehydrated and all that time they give water to the new plant, planted on top of them.
- **Fibres.** Opuntia cladodes can be converted to fibres that can have many purposes.

All mentioned prices below are just consumer prices. See chapter 2 how this leads to producers prices!

Fresh vegetables (cladodes).



Literature:

[Opuntia Italia](#). Very nice website with different opuntia products. Also with nice [news article here](#).
[Subito Arance](#). Nopal (Foglie Cactus). €3,49/Kg. Export prices to Northern EU are much higher.

Preserved cladodes.



Literature:

[RootSimple](#). [Four ways to Preserve Prickly Pear](#).

Powdered cladodes.



Literature:

[Etsy](#). [Nopal Cut & Powder](#). €80/litre (or Kg).
[Etsy](#). [Raw Nopal Cactus Powder, USA](#). €78/litre (or Kg).
[Etsy](#). [Nopal Cactus Pure dried organic 100% Pure Fiber](#). €100/Kg).

Fruits.



Literature:

[Ecosaf](#). [Market analysis of prickly pear \(Opuntia ficus-indica\) production](#) in Cochabamba, Bolivia.2017.
[Business Insider SA](#). [Why prickly pears are suddenly a hot crop in SA](#). Cactus fruits usually sells between €1-€3/Kg, depending on the season.

Processed and preserved fruits.



Jelly, jam, marmalade or syrup (when produced with more water.

Juice.

Literature:

[Amazon. AAGAM Prickly Pear Healthy Juice.](#) €9/litre.

[Outdoor hub. Top 4 Ways to Preserve Prickly Pear.](#)

[WikiFarmer. Pura di cactus biologica 5 kg.](#) €32/Kg.

Seeds & oil.



Literature:

[BioFlore. Opuntia oil.](#) €36,35/ 15 ml.

[AfricaNews. Tunisia prickly pear producers predict cacti cosmetics cash-in.](#) With mentioned price of €350/ litre average price.

[WikiFarmer Oil.](#) €345/litre.

[WikiFarmer. Seed selling.](#) €9/Kg.

Fodder cladodes.



Literature:

[Semantic Scholar. The Use of Cactus](#) as Forage for Dairy Cows in Semi- Arid Regions of Brazil

[SCE. Dietary Application of Opuntia in Animal Nutrition.](#)

Fire breaker and natural fence plant.

Water battery cladodes.



Literature:
[Desertification. Prickly pear \(Opuntia ficus-indica\) for living fences and livestock feed](#) in the drylands.
[Succulents and more. Prickly pear fence.](#)



Literature:
[Life Desert-Adapt](#) (publication will follow in 2023).

Fibres.



Literature:
[ResearchGate: Opuntia Fiber](#) and Its Potential to Obtain Sustainable Materials in the Composites Field: A Review.
[ResearchGate. Opuntia ficus indica fibers](#) as reinforcement in PHBV biocomposites.

2 Potential uses of the product or service, and prices.

The following are the most interesting uses of this specie.

International market

Type of use	Explain what it means
Powdered cladodes.	<p>After dehydration the cladodes can be grinded into powder form as a dietary supplement.</p> <p>Prices of such powder are expensive. Consumer prices range between €80-100/Kg or €32-40/Kg producer price (40% of consumer price, standard factor). Nevertheless producing such powder will be time consuming and costly. The fresh cladodes first need to be cleaned, dried and then grinded.</p> <p>1 Kg of fresh cladodes is about 800 gr of water. After drying this is 5%. Together with the fibres this means dry weight of Opuntia is about 10% of the fresh product. It means when you have 1000 Kg of cladodes you will end up with 100 Kg of dry matter, before grinding.</p> <p>How much you can harvest depends on the density of your plantation and how big and old your plants are.</p>
Processed and preserved fruits.	<p>Fruits can also be processed into many other things like any other fruits (jelly, syrup, jams, marmalade, juice etc). Fruits can also easily be frozen. See above for some examples of prices.</p> <p>Prices vary greatly, depending on the product. But the following can be said about your input material:</p> <ul style="list-style-type: none"> • A hectare planted with prickly pear can yield between 20 and 30 tonnes of fruit a year. This is Fresh fruit, including the shell and the seeds. • Fruit weighing between 100 grams and 150 grams in general, so it's difficult to assess how much fruit-pulp you end up with. • Cactus fruits usually sell between €1-€3/Kg consumer price, depending on the season. This leads to a producer price (40% of consumer price, standard factor) of €0,4-€1,2/Kg. • Harvesting the fruits is time consuming and costly. A farm needs about five people per hectare to harvest the crop while out-of-season up to one worker per hectare is required to maintain the cactuses. • Realize that the costs of making jams, syrup, marmalade, juices and gels are often not cost-efficient when producing small quantities. And you also need a clean kitchen/small factory area, which in many countries will go through governmental inspection at regular intervals.
Seeds & oil.	<p>The seeds, or pepins, are oleaginous, they contain an edible and cosmetic oil very rich in linoleic acid. This is more a cosmetic and protective oil of the skin than a food oil. Thus you can make oil from the</p>

	<p>seeds. Dried seeds are sometimes sold in the market, but not often. They bring you around €9/Kg (WikiFarmer. Seed selling.).</p> <p>Like so many essential oils these are expensive. These are marketed around €350/litre producer price. Roughly 5 litres can be produced per hectare. This means an income of €1.750/ha. <i>It is much more interesting to sell this directly to consumers: prices are almost 10 times the above.</i></p> <p>Production and exports grows every year. In Tunisia (a big exporter) they went from five processing companies (mainly focused on oil) in the early 2000s to 55 in 2021, including 11 in the region of Zelfen, organized into cooperatives. Nearly 8.000 liters were exported from Tunisia in 2021 for a turnover of 5 million euros (link).</p>
Fibres.	<p>Opuntia cladodes are formed by a network of fibres with a hexagonal reticular hierarchical structure, which is believed to be responsible for their mechanical properties. Opuntia fibre has a cellulose content about 50% and a density (1.54 g/cm³) similar to conventional fibres such as abaca (1.5 g/cm³), jute (1.3 g/cm³) and sisal (1.5 g/cm³). Matrices such as polylactic acid (PLA) and polypropylene (PP) have been reinforced with Opuntia fibres and with ground cladodes, mainly by compression moulding, increasing the tensile elastic modulus up to 135%. Opuntia fibres also offer good properties against energy absorption, being adequate for the design of lightweight materials with these characteristics.</p> <p>Fibres are still in research phase, no commercial product seems to be available.</p>

Local, national or regional market

Type of use	Explain what it means
Fresh vegetables (cladodes).	Traditionally the young cladodes of opuntia are used fresh in salad or after cooking in sweet dishes or with meat or vegetables. The cladodes contain a lot of water (on average 80%). Cladodes are nourishing but also dietetic by their mucilage content which "cuts" your appetite, delays digestion (and protects the digestive mucosa) and provides the body with minerals (including calcium). The older cladodes are often more astringent (presence of tannins). The recipes are varied according to the country (nopal is a traditional food in Mexico, and in South America).
Preserved cladodes.	After dehydration they can be canned (like green beans or spinach). Average composition of the dry cladode (the % varies according to the maturity of the plant): water 5%, carbohydrates 50 to 55%, 5 to 9% proteins, lipids 1.5 to 2.5%, fibers 10 to 20% and mineral ash about 20%.

Fruits.	<p>The fruit of the opuntia (or "tuna" in many Spanish-speaking countries) is oblong or rounded, varying in colour according to its maturity (from green to yellow to sometimes violet or red). Its size and weight also vary according to growing conditions and varieties (from 50 to 400g). The interior of the fruit is without partition, the pulp is red or orange, the seeds are numerous, pale brown, 4mm in diameter. The fruit is covered with fine spines, glochids, like on the cladodes but much smaller. They must be eliminated before eating, usually by peeling the fruit using a protective glove, or by rubbing the fruits with a cloth and then passing them under a water tap.</p> <p>Additional info from this source. (with South African prices) Fouché estimates that there are more than 900 local farms that devote a total of about 4 500 hectares to cactus pear production, including 1 500 hectares to harvest the fruit and 3 000 hectares for fodder. Cactus pear is a very labour-intensive crop during fruit harvesting, Fouché says. A farm needs about five people per hectare to harvest the crop while out-of-season one worker per hectare is required to maintain the cactuses. During the harvest, local farms employ up to 7 500 people to pick prickly pear fruit. In October in Pretoria a cactus pear fruit could sell for R7, or between R46 666 and R70 000 a tonne, with the fruit weighing between 100 grams and 150 grams, Fouché says However, in the midseason during January and February, when there is usually an oversupply, a cactus pear can sell for R2 or between R13 333 and R20 000 a tonne. A hectare planted with prickly pear can yield between 20 and 30 tonnes of fruit a year, he says. Assuming an average fruit yield of 20 tonnes per hectare, the value of the cactus pear fruit production harvested from 1 500 hectares at a price of R13 333 a ton could be worth at least R400 million.</p>
Fodder cladodes.	<p>In large parts of the world Opuntia is grown for fodder and animal feed in general. Worldwide it was estimated in the year 2000 that Opuntia was used as fodder on 900.000 ha, compared to only 100.000 ha of culture for the fruit. In arid areas planting prickly pears and other species of opuntia can be a solution to repeated droughts. The cladodes of Opuntia are a source of water and are quite nutritious for the animals while waiting for a better fodder. They are sometimes crushed and mixed with straw or other ruminant-tolerated feed sources. The majority of <i>cultivated</i> varieties are without sharp spines. The smaller fine spines on the fruit doesn't seem to bother the animals (who are eating mainly the cladodes anyway). The use of prickly pears and related species as fodder is common in Mexico, Argentina, Texas and neighbouring states, North Africa and Southern Africa.</p>
Water battery cladodes.	<p>In the Life project Desert Adapt project cladodes were used as a planting aid for young trees, plants and shrubs (of other species, not opuntia). After digging the planting hole 1 or 2 fresh cladodes were placed at the</p>

	bottom of the hole. They take a long time (up to 6-12 months) to become dehydrated and all that time they give water to the new plant, planted on top of them. After a heavy rainfall they are also able to act a sponge and become wet again. It could take years before they are fully composted.
Fire breaker and natural fence plant.	Opuntia almost doesn't burn. This is because of the 80% water in the cladodes. In a recent test location in the Life project Desert Adapt it proved that a hedge of Opuntia is actually capable of breaking a fire. The specie can be used as a fire lane, or fire buffer. Besides this it can be used as an natural fence. After a few years no animals are able to pass through it anymore because of the dense vegetation and the thorns.

Used literature:

- [Life Desert-Adapt species database.](#)
- [Pfaf database of species.](#)

General about Opuntia

- [CBI. The European market potential for exotic tropical fruit \(with Opuntia\).](#) Crucial report.
- [ScienceDirect. Phytochemical characterization of different prickly pear](#) (Opuntia ficus-indica (L.) Mill.) cultivars and botanical parts.
- [Phytomania. Figuier de barbarie nopal](#) figuier d'inde (French).
- [JPACDS. Performance of Cactus Pear \[Opuntia ficus-indica \(L.\) Mill.\]](#) Clones in Hot Arid Region of India



Natural fence, just planted.

3 Target customers, markets and competitors

International market

Market types			
Name of solution, product or service	Best target customers for each product: Explain your preferred target groups; consumers, retailers (shops), distributors, other landowners, wholesales, catering industry	Best target market for each product: Local, regional, national, international	Include basic information about the competitors. How big are they? Where are they located?
Powdered cladodes.	Production companies that use the powder for various ingredients (as mentioned in chapter 1). Consumers, & retailers , through online sales platforms, ready-made products by yourself.	International Because there is demand for this product is in each EU country (and outside the EU).	Very small number of competitors. Your main competition comes from the Southern EU countries. But it is small.
Processed and preserved fruits.	Consumers, & retailers , through online sales platforms, ready-made products by yourself.	International Because demand for this product could grow in each EU country (and outside the EU).	Hardly any competition. The few companies offering this are from various countries.
Seeds & oil.	Consumers, & retailers , through online sales platforms, ready-made products by yourself.	International Because demand for this product could grow in each EU country (and outside the EU).	Hardly any competition. The few companies offering this are from various countries.
Fibres.	Production companies that use the powder for various ingredients (as mentioned in chapter 1).	International Because demand for this product could establish itself in each EU country (and outside the EU). Maybe a good idea to check where the most important fibre industry is in the EU (outside the scope of this report).	No competition. Market doesn't exist yet.

Local, national or regional market

Market types			
Name of solution, product or service	Best target customers for each product: Explain your preferred target groups; consumers, retailers (shops), distributors, other landowners, wholesales, catering industry	Best target market for each product: Local, regional, national, international	Include basic information about the competitors. How big are they? Where are they located?
	To be sold locally		

Used literature:

- [Market news USDA \(Opuntia is not mentioned at the moment\)](#)
- [SCE. Contribution of Opuntia Species to Ecosystem](#). (with many more links).
- [ResearchGate. An Economic Analysis of Dryland Fruit Production of Opuntia ficus indica](#). 2001.
- [ResearchGate. Yield and Growth of Green Cladodes of Prickly Pear](#) (Opuntia ficus-indica) Cultivars under Different Plant Densities.

4 Market forecast

International market

Market forecast			
Name of solution, product or service	Describe the current market conditions. For example the forecasted growth or for example a regulation with direct influence on the market. Small/medium/big markets.	Demand. What do you expect? What information is it based on?	Price development. What do you expect? What information is it based on?
Powdered cladodes.	This is a small market at the moment. There are maybe up to 5 small/medium companies or websites offering such products in a more professional way in the EU.	We expect a steady & growing market for the years to come. Research have shown the potential of the specie and it is only a question of time when this is turned into real products on a larger scale. This is the right time to step into this market.	Current prices are high. This is caused by the small market and limited offer but also because there are hardly any plantations or steady supply. Prices remain high in the years to come and will probably only increase in the next 10 years.
Processed and preserved fruits.	There is hardly any market. There are maybe up to 5 small/medium companies or websites offering such products in each of the Southern Europe countries.	We expect a steady & growing market for the years to come. Research have shown the potential of the specie and it is only a question of time when this is turned into real products on a larger scale.	Current prices are very reasonable. This is caused by the labour intensive harvest but also because there are hardly any plantations or steady supply. Prices remain high in the years to come and will probably only increase in the next 10 years.
Seeds & oil.	This is a small market at the moment. There are maybe up to 5 small/medium companies or websites offering such products (the oil) in a more professional way in the EU.	We expect a steady & growing market for the years to come. Research have shown the potential of the specie and it is only a question of time when this is turned into real products on a larger scale. This is the right time to step into this market.	Current prices are very reasonable. This is caused by the labour intensive harvest but also because there are hardly any plantations or steady supply. Prices remain high in the years to come and will probably only increase in the next 10 years. Nevertheless prices are not that high when compared to



	For seeds there seems to be no market. They go directly into the oils.		other essential oils. But maybe that is simply because the harvest is a bit more efficient (better yield) when compared for example with aromatics.
Fibres.	No market. Market doesn't exist yet.	We expect the establishment of a new market, but very slowly. This we see with every new bio product. It could take years for somebody steps in and invest in a factory to make real fibres.	No prices are set. Market doesn't exist yet.

Local, national or regional market

Market forecast			
Name of solution, product or service	Describe the current market conditions. For example the forecasted growth or for example a regulation with direct influence on the market. Small/medium/big markets.	Demand. What do you expect? What information is it based on?	Price development. What do you expect? What information is it based on?
	Depends on small local markets.		

Used literature:

- [Amazon](#) (search per specie)
- <https://www.etsy.com> (search per specie)

5 Your opportunities & threats, and how to sell it.

International market

Your potential advantages and threats by selling this			
Name of solution, product or service	Explain opportunities by targeting this product or service.	Advise what the best ways are to sell this product or service (the marketing mix). Think about added-values, packaging, web-shops or not etc	What are the current threats to the market?
Powdered cladodes.	Good prices and growing market. You should enter the market now and also tell the story about the product. Maybe you can even combine it with an assortment of other Opuntia products.	Direct linking to producers of various ingredients (see chapter 1). Directly to consumers or retailers throughout online sales platforms. No need to sell to intermediate chain segments.	Direct competition with other producers. This is a niche market and have to be sold like this (unique product with a good story). In this the story is more important as the product.
Processed and preserved fruits.	Reasonable prices and growing market. You should enter the market now and also tell the story about the product. See above.	Directly to consumers or retailers throughout online sales platforms. No need to sell to intermediate chain segments.	Think about bigger production & sales otherwise it's not feasible. Sell this with a good story and create your own market. This will take time and effort.
Seeds & oil.	Good prices and growing market. You should enter the market now and also tell the story about the product. See above.	Direct linking to producers of various ingredients (see chapter 1). Directly to consumers or retailers throughout online sales platforms. No need to sell to intermediate chain segments.	Production standards. Added value processing comes with health & safety regulations from government but also from your customers. Direct competition with other producers. But we estimate this market is big enough to grow, so don't worry about this.
Fibres.	New market opportunities.	Direct linking to producers or factories.	Any developing market has risks. High costs for



	You will never know where this leads. Make sure you stay involved and be part of the development.		development, problems in health & safety and EU product permit/acceptance etc.
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Local, national or regional market

Your potential advantages and threats by selling this

Name of solution, product or service	Explain opportunities by targeting this product or service.	Advise what the best ways are to sell this product or service (the marketing mix). Think about added-values, packaging, web-shops or not etc	What are the current threats to the market?
	Depends on small local markets.		

Used literature:

- <https://www.etsy.com> (search per specie)

6 Potential customers.

List the potential customers for each products. List at least 5 potential customers for each product or service.

International market

Customers			
Name of solution, product or service	Name and location	website	Why?
<p>Powdered cladodes. If you prefer to sell this powder to other companies for ingredients you could target many traders in each EU country. Just to give you an example (note; most sites are in local language):</p> <p>Organic Nature, Portugal. YouHerbIt, Greek (sells leaves). Lia Incenses, Portugal. Just ingredients Trade, UK. Eko Plaza, Netherlands. Natural Spices, Netherlands. De Kruidenshop (Belgium). Bügel Germany. Bremer Gewurzhandel, Germany. Épices Røellinger (France). Italia Spezie (Italy). SpeciaTé. Italy. La Tienda de las Especies. Spain. Sosa, Spain.</p> <p>If you sell this yourself you can use the normal sales platforms around. See below.</p>			
a)	Amazon	https://www.amazon.com	Online sales platform, search for the specie.
b)	Etsy	https://www.etsy.com	Online sales platform, search for the specie.
c)	Tofillo	https://tofilllo.com	Herbs and tea trader.
d)	Ebay	https://www.ebay.com	Search the specie and see what is online now.
e)	Lazada	https://www.lazada.com.ph	Search the specie and see what is online now.
<p>Processed and preserved fruits. If you sell this yourself you could use the same sales platform as listed above under powdered cladodes. But besides that there can be hundreds of potential customers in each EU country. It all depends on the country and what market you target.</p>			
<p>Seeds & oil. If you sell this yourself you can use the normal sales platforms around. See above. You could also try to approach the ones below for their interest.</p>			
a)	Decléor	https://www.decleor.co.uk	Perfumery
b)	Farmaline	https://www.farmaline.be	Medical use
c)	Puressentiel	https://uk.puressentiel.com	Company in line with 'Nature' values and a good story.
d)	Eden botanicals	https://www.edenbotanicals.com	Serious trader with much experience.
e)	Osmanthos	https://osmanthos.com/perfume-ingredients	Buys ingredients for making your own perfume.
<p>Fibres. There is no industry yet. It could be that small initiatives takes place within several countries. Try to explore this yourself and contact these people. Stay in touch and assist in the development, as this is indeed a potentially interesting product for the future.</p>			

Local, national or regional market

Customers			
Name of solution, product or service	Name and location	website	Why?
Depends on small local markets.			

