



Small Crops of Amaranth and Nopal Plants

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Abstract: Amaranth and Nopal plants have been part of the Mexican diet of the inhabitants of semi-arid zones mainly, since ancient times. These two plants contain protein and grow with little water and intense solar radiation. They are usually found in open spaces in the country side. These plants have special dietary characteristics. Amaranth seeds contain between 13 and 18% protein and vitamins A, B, B1, B2, B3 and C, which gives it a high nutritional value. Due to their nutritional value they are recommended for children, older adults and specifically the Nopal for diabetics and the Amaranth indicated for celiacs since it does not contain gluten. Neither of these two foods have cholesterol. The Nopal has a fruit called prickly pear which like Amaranth, can also be eaten as candy. Nopal also has application in cosmetics and shampoo. They can be cultivated in small spaces, it is proposed to plant them in residential houses with small spaces for service patios, their plantation can be in drawers that require few wooden boards to build them. These products, in addition to being protein elements, help in the family economy by reducing expenses in proteins of animal origin. The waste can be used for small-scale composting.

Keywords: Nutritious Plant Foods, Ancestral Plant Foods, Semi-Arid Soils

1. Introduction

The socioeconomic situation worldwide continues to be difficult with the pandemic and different political and economic events, that have repercussions at a social level. The increases in the cost of beef and chicken have influenced the quality of people's diets.

However, there are alternative agricultural products that contain protein and can be grown in small spaces and included in the diet of nutritious food for people and even small animal species such as chickens and rabbits.

There are two examples of agricultural products that require less water and demanding soils for their cultivation compared to other crops, these are: Amaranth and Nopal. These plants are related to adverse agroclimatic conditions, such as drought, high temperatures and semi-arid soils.

The objective is to help improve the diet of residents of places with little free construction space to take advantage of it and cultivate these two minor species in a sustainable way and use them to improve their family diet by making use of them, which can reduce your expenses. in buying food and helping their economy.

Other advantages of both plants is that they can be used not only as food but also to obtain cosmetic products and the waste can be used to make compost.

2. Description of the Two Plants

2.1. Amaranth

It is a native and traditional specie from México that provides both leaves and edible seeds with a high nutritional value.

The Amaranthaceae family is comprised of more than 60 genera and 800 species of annual or perennial herbaceous plants. Only two species of genus Amaranthus are cultivated for the production of edible seeds [1].

They are the best known species: *A. hypochondriacus* and *A. cruentus* that are cultivated in Mexico and Guatemala, respectively. Both species are cultivated for grain. [2].

Amaranth is a plant whose central stem can measure up to 8 feet in height, however there are some varieties of this same plant that are shorter. It has very showy flowers, which sprout from its central stem, has cylindrical branches and has a short main root.

Table 1. Classification.

Kingdom	Vegetable
Division	Phanerogam
Guy	Embryophyta siphonogama
subtype	Angiosperm
Class	dicot
Subclass	Archyclamidae
Order	Cetrospermales
Family	Amaranthaceae
Gender	Amaranthus
Species	Caudatus
Scientific name	Amaranthus caudatus I.
Common name	Amaranth, Castile Quinoa
Floors	(%)
Sandy	88,6
Silt	5,4
Clayey	6
pH	Little acid

This plant has great capacities to adapt and survive the different environments in which it is grown. [3].

Table 2. Composition (%) raw Amaranth.

Water	12
carbohydrates	7
Protein	7
Fat	7

As can be seen in table 2; Amaranth seeds are a source of protein. They also contain several dietary minerals that are retained even when cooked, too contains calcium, magnesium, phosphorus and potassium. [4].

Crop

At home, cultivation can be done in a drawer. Sowing is done in groups 20 cm (7.87 inches) apart, depositing 10-20 seeds for each group.

It needs moisture only at the time of planting until the shoots appear.

The total amount of water required by Amaranth throughout its life cycle is only 60% compared to wheat or barley.

Its vegetative cycle has an average of 180 days, from when it germinates until the seed reaches maturity. It is important to have the plant in a place with light.

**Figure 1.** Cultivation in chest of drawers.

The main characteristics of Amaranth are:
 It is resistant to drought and frost
 Its cultivation is annual.
 Grows fast.
 Requires minimal maintenance.
 It has abundant and wide brightly colored leaves.

Their photosynthesis process is extremely efficient.

A new strain of *Amaranthus palmeri* has emerged that is resistant to glyphosate [5].

**Figure 2.** Amaranth in flower.

The main product that is extracted from the Amaranth plant are its seeds, known by the same name as it.

Amaranth seeds have between 13 and 18% protein, which gives them a high nutritional value, they also have Leucine, which is an amino acid whose function is to help protein synthesis in cells.

Of the foods of plant origin, Amaranth is one of the most complete since its composition includes vitamins: A, B, C, B1, B2 and B3. It is also a source of calcium, folic acid, phosphorus and niacin. Its protein concentration is higher than that of cereals.

It is also used as a raw material in the food industry to manufacture various products such as cereals, oils and sweets.

In 1979, the National Academy of Sciences and the FAO proposed that due to its high nutritional quality, amaranth could be a grain with great potential for commercial exploitation.

2.2. Nopal

Characteristics

The nopal vegetable belongs to the family of Cactaceae, specifically the genus *Opuntia*, subgenus *Platyopuntia*.

It belongs to the Cactaceae Family, Genus: *Opuntia*, Class: Magnolia sida. It has a hard texture, green color and thorny body. There are more than 100 species of this cactus in Mexico. The Nopal grows in any type of soil, sandy texture to clay-loam;). The exceptional drought tolerance and high water use efficiency of these plants are the main reasons for the popularity of prickly pear as a rainfed crop that receives little rainfall and has no water for irrigation. The plant can survive in areas that receive 200 mm per year. [6].

Table 3. Taxonomic classification of Nopal.

Vegetal	kingdom
Subkingdom	Embryophyta
Division	Angiospermae
Class	Dicotyledonae
Subclass	Dialipetalas
Opuntial	Order
Family	Cactaceae
Tribe	Opuntiae
Subfamily	Opuntioideae
Genus	Opuntia
Subgenus	Platyopuntia
Species	Various names

The Nopal is a fleshy and thick plant with diverse, with articulated branches, has leaves turned in spines which is a common feature in the cacti;

This plant has a very thick cuticle, almost all with spines; stores large amounts of milky juice or gummy (mucilage) that allows it to resist drought; [6].

Table 4. Chemical composition of 100 g of Nopal.

Components	Quantity
Carbohydrates	2.86 g
Proteins	1.45 g
Lipids	0.21 g
Cellulosics	3.77 g
Calories	19.95 Units
Thiamine	0.03mg
Riboflavin	0.03mg
Nicotinic acid	0.32mg
Ascorbic acid	10.76mg
Calcium	130.00mg
Phosphorus	21.00 mg
Iron	1.95 mg

Nopal have functional compounds for the body, both the fruits and the cladodes are a important source, including fiber, hydrocolloids (mucilages), pigments (betalains and carotenoids), minerals (calcium, potassium), and some vitamins such as vitamin C. [7].

Table 5. Nutritional Composition of Nopal.

Sodium:	5mh
Potassium:	220mg
Vitamin C:	14mg
Vitamin A:	43mg
Vitamin B09:	6mg

Fruit

He prickly pear is the turgid and sweet fruit, it has hundreds of seeds in its cavity and its development takes from three to six weeks, its shell is thin and its pulp is very juicy, it is what is consumed from this fruit. The xoconostle or acid prickly pear has a thick shell and very little pulp.

It contains numerous hard and small seeds, which vary between 100 to 400 per fruit. Sowing can be done in cultivation drawers having contours of 20 cm in height. [8].



Figure 3. Planting in pots.

Table 6. Classification.

Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Caryophyllales
Family	Cactaceae
Subfamily	Opuntioideae
Genus	Opuntia
Species	ficus-indica

Table 7. Nutritional composition of the Tuna.

Protein:	1g
Fiber:	3.6g
Fat:	0.4g
Carbohydrates:	7.1
Calcium:	80mg
Sodium:	5mg
Potassium:	220mg
Vitamin A:	43mg
Vitamin C:	14mg
Vitamin B09:	6mg
Calories:	40



Figure 4. Nopales with prickly pears.

3. Applications

3.1. Amaranth

It has the advantage that can be grown by dwellers with limited space to grow plants. Its main use is as food, but it is also used to make beverages and cosmetic products.

Flour and oils can be obtained from the Amaranth seed to be used in various confectionery preparations such as: cookies, sweet bread, empanadas and others.

Drinks can also be made with this cereal, such as smoothies, atole and beer.

Various studies have shown the beneficial effects of Amaranth for strengthening hair. For this reason, it has been included in cosmetics such as shampoos and conditioners. It is also used in skin creams.

Squalene is extracted as vegetable alternative to oil of shark. [9].

3.2. Nopal

Once the nopales are harvested, the superficial layer that has thorns must be removed.

The Nopal is used in food, it can be eaten cooked adding

some other ingredient such as cheese, egg or as a salad accompanied by other vegetables such as tomato, giving it greater nutritional and culinary value.

The potential of Nopal is extended by being able to be used as forage, reducing pressure on natural grasslands.

It is a plant that helps a lot to control desertification. It is also given medicinal use for diabetics.

It is a popular remedy for healing wounds, ulcers and gastritis.

It also has an industrial application to obtain textile dyes, in the cosmetics industry it is used to make shampoos and facial creams.

Nopal waste can be used as an input for home composters that can be easily made. Small-diameter holes are drilled all over a jar to aerate its contents. This is placed on a stand that allows you to rotate it every day. It is the way to make homemade compost to fertilize the land of the cultivation area. The time may vary depending on how late the decomposition process takes.

Prickly pears have their entire covering called shell removed so that the fruit can be eaten. These shells can be used in a home composter to which food waste and other fruit shells can be added. [10].

4. Conclusions

Both Amaranth and Nopal are two crops with low water requirements, easy to grow in small spaces or in large areas of land. Both with nutritional and human health benefits and industrial also.

These products, in addition to being protein elements, help in the family economy by reducing expenses in proteins of animal origin.

The waste can be used for small-scale composting.

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