

CONSIDERATIONS ON THE IMPORTANCE OF JERUSALEM ARTICHOKE CROP IN HUMAN AND ANIMAL FEED

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Keywords: *Jerusalem artichoke, inulin, earth apple.*

ABSTRACT

This paper aims to provide rich and updated information on the importance of the crop of Jerusalem artichoke (*Helianthus tuberosus*(fig.1) [8] - Asteraceae or Compositae family) in human and animal feed. Jerusalem artichoke is a plant that can be used in animal and human feed, as windbreaks in agriculture, for manufacturing pellets for heating installations, etc. Inulin, a group of oligosaccharides, is used in the food industry because of its particular nutritional characteristics.

INTRODUCTION

It is a newer plant brought into Europe only in the eighteenth century. The origin of this plant is in the colder and temperate area of America where it grows spontaneously [1]. The name Jerusalem artichoke comes from Native American tribe "Topinambas" [6].

Jerusalem artichoke is a crop plant from which is used, like from potatoes, the underground tubers [6]. It did not overextend in any region, although it possess many useful properties. It is cultivated in larger areas in the Russian Federation, in our country occupying very small areas [1].

The plant is also known as "earth carrot", "crow's potato" or "earth apple". It is very resistant and ensures substantial income for farmers. [7]

It is often confused with turnip (*Brassica napus* from *Brassicaceae* family) [8].

Jerusalem artichokes can be considered as the most rustic crop plant. It is less demanding in term of climate factors, due to this fact it is suitable in any climatic zone, reaching north to the 64° parallel. It endures very well drought due to its deep roots, only being harmed by excessive moisture [1]. It occupied small areas, because the harvested tubers are kept with difficulties in barns over the winter and the crop infests the land [2].

It's good for the turnips to be kept in the ground and harvested in spring, because they do not freeze during winter. Turnips removed from the soil in the spring are sweeter because the inulin contained is converted into fructose, which gives a sweet taste [3].

In terms of ground is also very less demanding being suitable both on light soils and on heavier ones, production in neither case being influenced too much. Soil reaction does not play a role in the development of Jerusalem artichoke, only a too big acidity harming them. [1]



Fig. 1 – Jerusalem artichoke (*Helianthus tuberosus*)[8]

MATERIAL AND METHOD

From a botanical point of view, Jerusalem artichoke is closely related to sunflower (fig. 2). Its root is fibrous, strong, reaching great depths. It is equipped with stolons bearing tubers of different shapes and colors serving for plant propagation, giving it a liveliness character (fig. 3). [1]

The stem of the plant is an annual, erect and up to 2 m high. The leaves are alternate, ovate-cordate at the base and oval-lanceolate at the peak. The flowers are arranged in heads about 3.8 cm in diameter, being grouped, like in the case of sunflower, in ligulates with yellow petals at the exterior and hollow towards the inside. It blooms very late, but only fructifies in regions situated further south. The entire plant is hairy. [1]



Fig.2 – Jerusalem artichoke stem [1] **Fig.3 – Jerusalem artichoke tubers** [1]

Tubers are used as fodder for cattle, same as potatoes, but unlike them, they can be given to animals in crude form.

The stems can be used as pickled fodder before flowering. [1]

Jerusalem artichoke tubers have a sweet taste, because they contain *inulin*, a group of oligosaccharides containing fructose [6]. They belong to the class of carbohydrates known as fructans. They are also found in the roots of chicory (*Cichoriumintybus*) and Jerusalem artichoke (*Helianthus tuberosus*). [5]

Inulin is used in the food industry because of its particular nutritional characteristics: it has a neutral or slightly sweet taste, which makes it the perfect replacement for sugar, flour and fat. The advantage of inulin is that it provides a third or a quarter of the energy given by sugar or other carbohydrates and 1/6 or 1/9 of the energy delivered typically by fat and is used in place of fat and sugar in many food products, (ice cream, milk, pastries) to reduce their caloric value. [4]

As food for humans, the tubers are quite sweet and tasty, being possible to consume them in raw state as well as cooked (boiled, fried, salad with onions and parsley, with melted butter and bread crumbs) [8].

It is increasingly used as food for diabetic patients because it contains a polysaccharide that is tolerated by patients with high blood sugar. It can also be used to obtain various alcoholic beverages [6].

Content of 100 g of Jerusalem artichoke [6]:						
kcal	kJoule	Water	Proteins	Lipids	Carbohydrate	Ballast
31	130	78.465 g	2.44 g	0.41 g	4 g	12.5 g

Content of 100 g of Jerusalem artichoke [6]:											
Carbohydrate	Linoleic acid	Lino acid	Minerals	Sodium	Potassium	Calcium	Magnesium	Phosphorus	Iron	Zinc	Copper
0.33 BE	44 mg	0.165 g	1.74 g	3 mg	478 mg	10 mg	20 mg	78 mg	3.7 mg	60 µg	0.150 mg

Vitamin content of 100 g of Jerusalem artichoke [6]:						
A	B1	B2	B3	B5	B6	B7
2 µg	200 µg	60 µg	1.3 mg	60 µg	90 µg	1.7 µg
B9	B12	C	D	E	K	
31 µg	0 mg	4 mg	0 mg	1.3–2 mg	0.023 mg	

Non nitrate extractives are not found in the form of starches, but as inulin and sugar. [6]

The proteins that are found in tubers contain eight essential amino acids arginine, valine, histidine, isoleucine, leucine, lysine, tryptophan, and phenylalanine. The leaves contain 4% tryptophan, leucine, and beta-carotene in an amount of 45 mg / 100 grams [3].

The pulp remaining after squeezing the juice contains about 30% protein, which is much more than in wheat bran and soybean. Jerusalem artichoke tubers are a raw material for food industry and are a valuable animal feed [9].

RESULTS AND DISCUSSIONS

There are several varieties of Jerusalem artichoke, classified by shape and color: white and elongated (Nantes and Croissy), yellow ("Boule d'Or"), black (tubers can be round or oblong) and red-pink. The most spread in our country is "pigturnip" [3].

In order to establish a crop on a one hectare area, an investment of about 4,000 lei is required, an amount necessary for the purchase of Jerusalem artichoke tubers. Pink-

brown variety has a higher quality compared to the one of other local varieties, because it generates a higher yield by 20% and tubers are sweeter. They are planted in the nests, like potatoes, at a distance of about 30-40 cm from each other, because the plant expands rapidly. [7]

In the first year of culture it is not necessary to use fertilizers and the plant's increased resistance to pests recommends it for organic production. The only known pest is the field mouse. [7]

Due to the large stems, which for some varieties exceed 3 meters in height, it can be used successfully to create protective windbreaks to protect more sensitive crops from cold winds or to prevent moisture evaporation from the soil. [7]

The stems can also be used to produce pellets for heating installations. [7]

Moreover, the tubers can be used successfully to obtain biomass for biofuel or the rubbing alcohol industry. From 100 kg of tubers result 7-10 liters of alcohol with a strength of 35 degrees and about 60 kg of pulp. [7]

They can also be used as animal feed or in the food and medicines industry. [7]

CONCLUSIONS

The results and materials provided in this paper represent a synthesis on the major aspects of Jerusalem artichoke, a plant that should produce an interest becoming higher for farmers due to its nutritional properties in human and animal feed. Also, a particular importance is represented by the stems in manufacturing pellets for heating installations, windbreaks, green fertilizer, etc.

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