# PRELIMINARY STUDIES FOR THE INTRODUCTION OF THE JERUSALEM ARTICHOKE (*HELIANTHUS TUBEROSUS* L.) IN THE ROMANIAN VEGETABLE PRODUCTION

## STUDII PRELIMINARE PENTRU INTRODUCEREA ÎN CULTURĂ A TOPINAMBURULUI LEGUMICOL (*HELIANTHUS TUBEROSUS* L.)

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***Abstract.*** *The paper is based on a documentary as well as on a field study regarding the importance of the culture, the biological and ecological characteristics of the Jerusalem artichoke species (Helianthus tuberosus L.). Moreover, some extremely important information regarding the importance of the Jerusalem artichoke in man's diet, the risk factors of the culture has been detailed, which provides a more thorough documentation of a growth technology for this species in Romania's climate.*
**Key words:** Jerusalem artichoke, botanical characteristics, importance of the culture, ecological characteristics, risk factors.

***Rezumat.*** *Lucrarea constă într-un studiu documentar și în teren privind importanța culturii, particularitățile biologice și cele ecologice ale speciei legumicole topinambur (Helianthus tuberosus L.). În plus, au fost evidențiate și unele informații deosebit de utile privind importanța topinamburului în alimentația omului, factorii de risc ai culturii, care asigură o mai completă fundamentare a unei tehnologii de cultivare a acestei specii în condițiile din România.*
**Cuvinte cheie**: topinambur, particularități botanice, importanța culturii, caracteristici ecologice, factori de risc.

## INTRODUCTION

Jerusalem artichoke is grown for its tubers which can be eaten boiled (in most cases, in soups or other flavored dishes), baked or even raw, for their special taste and nutrient value. When eaten raw, the tubercles can be thinly sliced for different types of simple or assorted salads especially for enriching the salad with a crunchy texture and a slightly taste of walnut. They can also be canned, used as simple pickles or assorted.

In Europe, Jerusalem artichoke tubers are used especially for preparing the so-called „ Palestina soup" (Grigson, 1978). In France, the tubercles have been avoided for a long period of time because of their culinary value, but lately more and more exquisite restaurants have added a variety of Jerusalem artichoke dishes on their menu lists (Henning, 2000).

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The chemical composition of Jerusalem artichoke tubers for 100 g of fresh product is : 80% water, 15% carbohydrates, 1-2% proteins, 0,1-0,6g lipids, 0,6-4 g fibers. The content of the tuber in macro elements, calculated for 100 grams of fresh product is: 560 mg potassium, 0,25 mg nitrogen, 25 mg calcium, 3,4 mg iron, 16 mg magnesium, 3 mg sodium, 78 mg phosphor, 0,1 mg zinc, 0,6 μg vitamin A, 0,3 mg vitamin B1, 0,005 mg vitamin B2, 0,5 mg niacin, 0,09 mg vitamin B6, 13 μg acid folic.

Jerusalem artichoke is a species with certain distinctive biochemical properties. Inulin is stored in the tubers as reserve substance while other species have starch as reserve, the main source of carbohydrates. Inulin, together with a high content of mineral salts render the Jerusalem artichoke a great importance in human diets, especially, for the diets of the persons suffering of obesity and diabetes.

The energetic value of the fresh Jerusalem artichoke tubercles is 650 kcal, and cooked (boiled tubercles) 410 kcal.

The agronomic importance of the specie comes from the fact that Jerusalem artichoke can be very well grown in fields with low fertility as a crop that requires minimal works. Actually, great productivity can be achieved, in quantity as well as in quality, by using modern technologies in growing Jerusalem artichoke. Jerusalem artichoke can be grown on a variety of systems and types of cultures: in the field, in intensive or sustainable systems (such as ecological culture) or for household use, on his own field or in vegetable associations.

The economical and social importance derives from the fact that Jerusalem artichoke ensures considerable revenues within a consolidated market, with demands for this product in a balanced report with the expenses.

The profit of the culture is low if there is no incisive scientifically documented promotion on the market in order to increase the demand for this product. In the case of the ecological culture, the demand for Jerusalem artichoke tubers is higher due to better information of the customers, so the profit of the culture is higher. The tubers can be easily stored for 6 to12 months, if the appropriate technical solutions are used, maintaining a relative higher humidity in the storage spaces and a low temperature (between 0-2°C) in order to determine a decrease in the breathing process of the stored tubers.

The advantages and disadvantages of the Jerusalem artichoke culture must be completed by some risk factors which can compromise the crop and the measures that must be taken to avoid this.

In their chronological order of manifestation, the main risks are (synthesis according to Stanley, 2008):

- using planting material that has been infected with a virus determines a delay of the culture, reduced growth, decrease in production from the point of view of its quantity as well as of its quality,
- setting up a culture within an improper rotation (the species being extremely sensitive to *Sclerotinia sclerotiorum* Lib) which leads to a compromised culture.

Our paper wants to present the main aspects regarding crop importance, biological and ecological features in connection with same cultivar practices.

## MATERIAL AND METHOD

The present study was realized based on the analysis of the information existent in the specialized literature.

The biological and ecological characteristics, the risk factors and the importance of the Jerusalem artichoke have been analyzed and the work method was the comparative analyze method of the information in the specialized literature in Romania and the one abroad.

## RESULTS AND DISSCUSSIONS

*Helianthus tuberosus* L. species belongs to the *Helianthus* type, which is part of the *Asteraceae* family, *Asterales* order, genomic formula 2n=102.

There are 10 species of the *Helianthus* type, but because of the high number of natural hybrids, some authors classified more than 70 species within the same gender (Heiser, 1995).

**Biological characteristics**. Jerusalem artichoke, when in a culture is behaving like an annual species, although at its origin places and in its spontaneous form it is a perennial species.

The plants are herbaceous, but in the second period of their life cycle in a year it begins to wooden around the area of the main roots and the inferior ramifications.

The root presents itself in a fibrous system, strongly developed in the above soil layer as well as deep in the ground. The weight of the dry matter of the root is bigger in the case of the cultivated clones (15 g), in comparison with the spontaneous populations (12,7g / plant) (Swanton, 1986).

Jerusalem artichoke has two types of stems: underground and aerial. Underground stems are represented by rhizomes (incorrectly called stools by some authors) and tubers. Rhizomes are slightly thickened underground stems with a length of up to 1,5 m (fig. 1), generally of white color, which can also form tubers by turning their ends into tubercles. When the formation of rhizomes is inhibited, just as it is the case of the cultures on compacted soils, the tuber production greatly decreases.

The tubers can have a variety of shapes, from rounded-elongated to an irregular shape with a lot of secondary tubercles, cluster type (Alex and Switzer, 1976), of smaller or bigger dimensions according to the clone and climate conditions. Three types have been found: big, more than 50g / tuber; medium, 20-50g / tuber, small, less than 20g / tuber (Pas'ko, 1973).

The tubers can also present nodes where secondary tubercles appear (an undesirable fact for commercial cultures).

The external color of the tubercles can be: white, red and violet or violet or dark-brown; the internal color, the most frequent, is white or white with a shade of pink (Pas'ko, 1973).

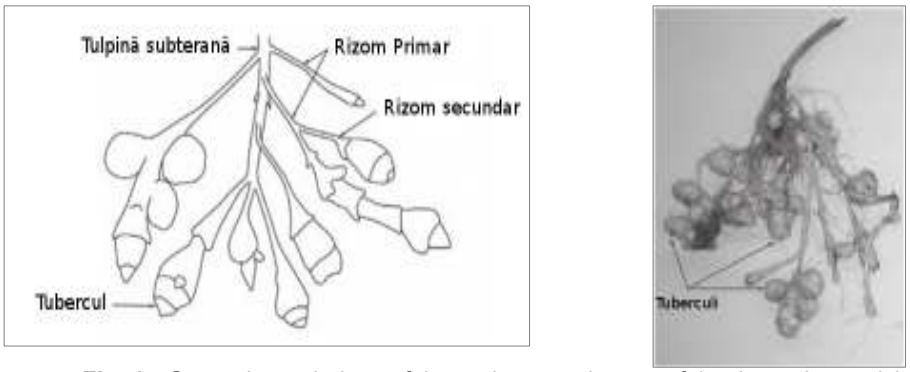


**Fig. 1 -** General morphology of the underground stem, of the Jerusalem artichoke rhizomes and tubercles. (after Kays, 2006)

On the surface of the tubercles, there can be noticed the "eyes" situated in a pocket, being formed of several buds. The eyes are disposed along a spiral line around the tuber, being scarce at the base and denser towards the ends, just like the potato tubers (Stan and Munteanu, 2001). In proper conditions, from an eye aerial stems are formed. The number of stems that emerge from a single eye varies from one to three main stems, depending on the cultivar.

The aerial stem is straight, with a well developed mechanic tissue and can reach a height of 3 m or even more. In the culture there are also known „dwarf" clones, with a height of about 1 meter (Zubr and Pedersen, 1993). The number of the ramifications varies very much according to their position on the main stem. In the case of the clones with very tall stems, for example 4 m, the number of the tubers is lower.

The leaf is simple, lanceolate or lance-ovate of 10-20 cm in length and 5-10 cm wide, acuminate, serrated, pubescent on the inferior side, with acuminate at the end (fig. 2).

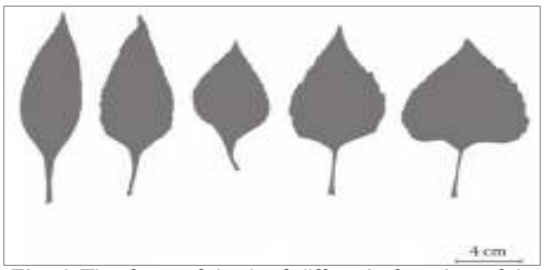


**Fig. 2.**The form of the leaf differs in function of the clone (according to Tsvetoukhine, 1960)

The flowers are grouped in a calathidium type of inflorescence (fig. 3), specific to the species of *Asteraceae* family. The inflorescence has on the exterior a row of lingule sterile flowers, golden yellow, counting 10-20 flowers and on the rest of the surface of the calathidium a lot of tubular hermaphrodite fertile flowers with successive blooming.


**Fig. 3 -** Section at the inflorescence level to highlight the receptacle, the bracts and the flowers in different stages of development (according to Betty Schroeder, 2008)

Considering the number of inflorescences on the plant, Jerusalem artichoke cultivars are classified in three categories:

− with a reduced number, 1-15 inflorescences

− with a medium number, 16-49 inflorescences

− with a high number, 50-155 inflorescences (Pas'ko, 1973).

The fruit is an achene, in normal conditions the fruits are formed in a reduced number (Russel, 1979). Their external color can be black, gray, brown with dark spots (Kanvalinkova, 2003). Spontaneous populations produce more fruits (3-50 for every inflorescence), in comparison with the ones in cultivation (0,08-0,66 for every inflorescence) (Westley, 1993).

**Ecologic characteristics**. As a perennial species, the Jerusalem artichoke, is cold resistant and it can usually stand temperatures of -10 °C and -15°C, even if the ground is not covered by snow. It is a rustic specie because it can be found in areas like Alaska (Duke, 1983), but at the same time it can appear in extremely dry areas with high temperatures (center Spain, south Italy, North Africa). The part of the plant that grows outside the ground is sensitive to freezing temperatures and can be destroyed at temperatures below 0°C. The optimal temperature for its growth and development is 26,6 °C (Xiao Yong Ma et al., 2011).

Regarding the light, Jerusalem artichoke needs full daylight during its vegetation period up to its maturity and for forming tubers short daylight conditions are sufficient. (Huxley et al., 1992). Thus it can be stated that Jerusalem artichoke is sensitive to light during its vegetation period.

Jerusalem artichoke can tolerate medium precipitations during the year which go between 310 and 2820 mm. it can endure drought conditions although in its original location the precipitations are medium. This phenomenon was demonstrated through experiments done in south of Italy: thus the Jerusalem artichoke grown in a system without any irrigations, with precipitations of 125 mm from June to September, still in this conditions the yield of tubers was 10 to/ha (Macella et al., 1996).

The topinambur can be grown in most of the soils, but it has better results in soils with a light texture and a slightly alkaline pH. Although the production is

better in clay soil, rich in nutrient elements, because of the difficult harvesting it is not recommended to cultivate the Jerusalem artichoke in these soils.

Jerusalem artichoke is generally considered to be tolerant to soil salinity (Long et al., 2008, Newton et al., 1991), as its culture is possible in partially saline soils or in irrigated system with saline sea water (Chittendon, 1951).

## CONCLUSIONS

1. After this study realized, based on information comprised in specialized literature, sufficient data has been structured for documenting the nutrient value, agro technical and economical importance of Jerusalem artichoke.

2. It also could be raised significant environmental and biological features necessary for introducing the vegetable species of *Helianthus tuberosus* L. into the crop production from Romania.

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