Last updated: **14th October 2002**

JERUSALEM ARTICHOKE

Family: *Compositae*

Genus: *Helianthus*

Species: *tuberosus*

Source: http://www.bionet.schule.de http://waynesword.palomar.edu/images/helian1b.jpg

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General Background

Like its close relative the sunflower, Jerusalem artichoke (sometimes known as sun choke) is a native of North America and was cultivated pre-Columbian times in the north-eastern United States up to the middle of the 18th century when it was superseded by the potato. Jerusalem artichoke is grown in most European countries in home- and market-gardens, but rarely as a field crop. The plant is an annual herb with stems 1-3m tall, with vegetation similar to sunflower but perennating by stem tubers. The upper stems are multi branched and slender. Leaves are opposite, ovate and often coarsely toothed, prominently veined with broad winged stalks. For flower production, short day conditions are required. The flower heads when produced are much smaller than sunflower, being only 4-8cm in diameter with yellow disc and ray florets, and are carried individually on branch stems. The whitish/yellow tubers, formed late in the season are numerous, up to 12 x 6cm long, very irregular and knobbly in unselected forms but almost smooth in others, and with crisp flesh.

Details of Quality Characteristics

The tubers contain 13-18% carbohydrates, of which nearly 80% are the carbohydrate inulin, a natural polymer of fructose which cannot be absorbed by the body. The inulin is isolated on the basis of its high solubility in hot water, and techniques similar to diffusing sugar from beet are used. The polysaccharides precipitate on cooling. Inulin can also be extracted by *in situ* hydrolysis of sliced bulbs by acids or fructanases.

The Nitrogen values of Jerusalem artichoke are relatively low at around only 2.69%, digestibility of nitrogen as a stock feed varies from 19-21%. Ash content of the crop is relatively high when fed as a forage source.

Current Production and Yields

Yields tend to vary with soil conditions, cultivar and season, but fresh weights in excess of 100t/ha have been recorded. Tubers are crisper and sweeter if harvested after some frost and even more so if they remain in the soil until early spring. Sugar

yields of around 8t/ha have been achieved from the crop in the absence of water and weed stress. Under these optimal conditions with optimal N applications the crop have been shown to achieve root and dry matter yields of 11.5t/ha.

Constraints upon Production

Plants will only flower in the UK and northern Europe after an exceptionally long warm summer. For this reason chicory is likely to be a more reliable source of inulin than is Jerusalem artichoke. However, in the poorer soils where no other crops will thrive, this crop may well be a more reliable option. A notable disadvantage of the tubers is their limited storage capacity. The thin skin on the tubers is easily damaged and allows moisture to be lost readily, causing shrivelling. If the tubers are stored for more than five months up to 20% may be lost due to decay and shrivel.

Markets and Market Potential

The high-fructose syrups derived from the tubers may be used primarily as sweeteners in the food industry, also for the production of ethanol (yield 8-10 litres from 100kg of tubers) and other industrial raw materials. There is a large amount of top growth which is suitable for use as cattle fodder, it may also be useful as a storage of biomass for energy.

Other Information

Jerusalem artichoke does not require particularly high soil fertility to produce acceptable yields. Tubers are planted in early spring in rows 75-100cm apart, to give a final spacing of about 35 plants per m^2. Weed control can be assisted by ridging, this also aids tuberisation. Chemical control will not be required if good field selection, cultivation and rotations are applied although Linuron products are cleared for pre-emergence use. Rapid crop growth suppresses any weed growth post-emergence. During the first three months of growth nutrient uptake is rapid and fertiliser requirements can be met by application of 75-100kg per ha of nitrogen and phosphate, and up to 250kg per ha of potash.

Slug control is important, if allowed to become a problem in the crop the most effective method of minimising damage is to harvest the crop in autumn prior to increased activity.

Productivity and partitioning of dry matter has been examined in several European countries in an attempt to optimise cultural methods. At the onset of flowering top growth ceases and assimilates are transferred to the tubers. Tubers can be harvested during October or November, but they are frost hardy and can be left in the ground until required. The crop is very invasive and tubers that are left in the ground at harvest cause volunteer problems for a number of years. A potential cure for this problem is that the small tubers can be left to produce a full crop for the following season.

Research

Research has been carried out to establish whether wastewater can be applied to this crop having no detrimental effects on yield or quality, it has been proven to be successful for commercial production of value added products.

Sugar is produced in the top of the plant and is transported down to the tubers closer to maturity. It has been established to aid harvesting that the upper stems of the plant may be harvested in the earlier stages of growth and the tubers may remain in the ground until the following season to allow regeneration. This would allow conventional harvesting techniques to be applied and reduce the need for specialist equipment.

Although the crop is not currently being commercially produced across Europe, scientific interest and development is currently on-going in Belgium, France, Germany, Italy, Netherlands and UK.

Useful Websites

http://www.waushara.net/garden/vege/jart.htm - The Jerusalem Artichoke Page

http://www.holoweb.com/cannon/jerusale.htm - A range of general information on the Jerusalem artichoke

BioMat Net

Jerusalem artichoke (Helianthus tuberosus)

FAIR-1896 - Production of Novel Fructans Through Genetic Engineering of Crops and Their Applications

Crops for Biopolymers/Gums

Crops for Fine Chemicals

Crops for Liquid Biofuels

National Activities – Italy – Microeconomic Analysis of Herbaceous Energy crops – A Case Study in Italy

FAIR-0512 – European Energy crops Processing and Utilisation in Europe

Cardoon (Cynara cardunculus)

Chicory (Cichorium intybus)

Contacts

References

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Smith, N.O., Maclean, I., Miller, F.A. and Carruthers, S.P. (1997) *Crops for Energy and Industry.* Office for Official publications of the European Communities

Zoebelein, H. (1997) *Dictionary of Renewable Resources.* VCH