

JERUSALEM ARTICHOKE PRODUCTION



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INDEX

1. Jerusalem Artichoke: An Introduction	1
2. Growing Practices	2
3. Harvesting	7
4. Post Harvest Management	7
5. Uses of Jerusalem Artichokes	8
6. Medicinal Properties	9
7. Economics of Production	9

Jerusalem Artichokes or Sunchokes: An Introduction

Jerusalem artichoke is a popular root vegetable of temperate regions. Jerusalem artichokes are also known as sunchokes; sunroots; earth apples; and girasol. Jerusalem artichokes are very hardy plants with a mature height of 2.5 to 3 meters and a mature spread of 60 centimeters.

Taxonomy

Jerusalem artichoke is a member of Asteraceae family that includes plants like sunflower, daisy, and chrysanthemum. Botanical name of Jerusalem artichoke is *Helianthus tuberosus*. A detailed taxonomic classification of Jerusalem artichoke is as given in Table 1

Kingdom	Plantae
order	Asterales
Family	Asteraceae
Tribe	Heliantheae
Genus	Helianthus
species	tuberosus
source	USDA plants database

Origin and Distribution

Jerusalem artichoke is a native of North America, particularly the United States of America. Scientific researches on the origin of Jerusalem artichoke point out to the fact that Native American Indians have long been using Jerusalem artichoke as a major food. Over the years, Jerusalem artichoke has been introduced in both northern and southern hemispheres and gradually became naturalized in all temperate regions.

Cultivars

'Jerusalem White', Veitch's Improved Long White', 'Sutton's New White', 'Mammoth French White', 'French White Improved', 'Columbia' and 'LSD' are a few commercial cultivars those propagate vegetatively. Other commercial varieties are as shown below: -

Stampede

- Stampede is an early yielding short season variety of Jerusalem artichoke.
- The crop matures within 90 days with its flowering starts in July and tubers are ready in September.
- Stampede produces white colored tubers, each tuber weighing up to 1/2 lb each.
- Each plant may yield up to 10 lbs or more of tubers.
- Stampede is an extremely productive, high yielding variety of Jerusalem artichoke.
- Tubers are normally produced in big clusters near the main stem and hence they are easy to find while harvesting.

White Fuseau

- White Fuseau is another highly productive variety of Jerusalem artichoke.
- But it is a late season variety.
- White Fuseau, as the name suggests produces white colored underground tubers which are large, long, crispy and knob-free with a thinner skin than other varieties.
- White Fuseau has one of the most favored flavors among the cultivated Jerusalem artichoke varieties and hence a much preferred selection for commercial cultivation.
- This variety is highly vigorous in growth habit and hence spreads quickly.

Red Fuseau

- Red Fuseau is another cultivated variety of Jerusalem artichoke which is preferred for its crispy, good flavored and thin, smooth skinned tubers.
- Red Fuseau produces red colored, small round and oblong shaped underground tubers in dense clusters near the main stem.
- It is an early yielding, highly productive variety of Jerusalem artichoke.
- It is also vigorous in growth habit with a height of up 10 ft. on maturity.

Clearwater:

- Clearwater is another high yielding variety of Jerusalem artichoke.
- Clearwater produces long thin tubers like those of white Fuseau tubers except that tubers are with few knobs.
- Clearwater has the most non-artichoke flavor compared to other commercial cultivars.

Seed Grown Jerusalem Artichoke

- Jerusalem artichokes are sterile and rarely produce any seeds.
- Seedlings that are grown from seeds are very rare.

Red Rover

- Red Rover is a prolific variety of Jerusalem artichoke and it grows up to 12 ft. in height
- and spreads quickly.
- Red Rover produces red colored smooth thin skinned tubers which are generally knob-free.
- Red Rover tubers are large with an average 1" in diameter and up to 6" in length.
- It ripens in October.

Waldspinel

- Waldspinel Jerusalem artichoke produces small, red colored underground tubers with a bumpy surface

Botanical Description

Plant: Jerusalem artichoke is a tall, perennial herbaceous plant with erect, hairy stems and hairy, rough leaves. Though it is a perennial plant, it is often cultivated as an annual in commercial production. It grows up to a height of two to three meters. Leaves are with winged petioles; serrate-dentate; ovate to oblong shaped and are arranged in opposite directions on the lower stems; while alternate arrangement of leaves is seen towards the top of the plant.

Flower: Yellow colored flowers are produced terminal on the branches and resemble a sunflower in shape and size. Size of the flower head varies from 5 cm to 7.5 cm across that contains a yellow colored disk and ray florets up to 12 to 20. Flowering time is normally in July to August.

Rhizomes: Edible portion of a Jerusalem artichoke plant is its modified underground tubers which are botanically termed as 'rhizomes'. Tuber color varies from white to brown to red depending on the cultivar. Elongated and irregular shaped tubers are produced at the ends of the underground stems. Knobby or knob-free tubers are produced depending upon the variety. Size of each tuber varies from 7.5 cm to 10 cm in length and 3 cm to 5 cm in thickness.

Ecology: Jerusalem artichoke is a hardy plant that can be grown in any soils and under any climatic conditions though temperate climate is generally preferred. The plant is susceptible to frost injury and the first frost normally kills the vegetative growth; however tubers withstand frost injury. It grows best in full sun and with plenty of water. Plants are sensitive to day length and hence they do not flower in northern Europe where days are very short. Plants require longer days from planting to maturation period and short days during tuber formation.

Nutritional Value

Jerusalem artichokes are high in potassium, iron, dietary fibers, niacin, thiamine, copper and phosphorus. Nutritional value of a half-cup serving of Jerusalem artichoke preparation is, 327 milligrams of potassium; 57 calories of energy; 1.5 grams of protein; 1.2 gram of dietary fiber; 10.5 milligrams of calcium, and 10 mcg of folacin along with smaller amounts of niacin and thiamine.

Production Requirements

Jerusalem artichoke plants are very easy to grow as they are very hardy plants and once roots are established on soil, they tend to grow vigorously with little nutrition and less care. A thorough soil preparation is normally done in commercial cultivation of Jerusalem artichokes. Soil is prepared well by adding and mixing bulk quantities of compost and well rotted farm yard manure liberally into the top soil and then adding a little lime just before planting Jerusalem artichoke tubers. After planting is done, soil is kept free from weeds all throughout its production duration. It is necessary to keep the soil slightly moist always.

Climatic requirements for Jerusalem artichoke

Jerusalem artichokes are better adapted to cool climates. Temperature requirements vary from 65 to 80°F and rainfall requirements vary from 50 inches or less. Crops are grown both as rainfed and irrigated crops. Irrigation may be necessary for rainfed crops also, if soil is dry.

Soil Requirements

Jerusalem artichoke is adapted to various soil types but the best soil is fertile sandy loams or well-drained, slightly alkaline soils. Generally speaking, soils suitable for potato and corn production are suitable for Jerusalem artichoke production also. Water logging must be avoided but soil moisture must be well above 30% of field capacity during the tuber formation period which starts from late August to early September and lasts up to November.

Propagation of Jerusalem artichoke

Vegetative propagation via seed tubers is generally preferred in Jerusalem artichoke. Tubers or pieces of tubers containing two or three vigorous buds and weighing approximately 50-60 grams are used for the propagation of Jerusalem artichoke. Tubers start sprouting after two to three weeks of planting. During plant establishment, grass and weed problems will be reduced by shading since plants grow over 6 feet high. Tubers begin to form in August and may become 4 inches long and 2 to 3 inches in diameter upon full growth.

Planting

Recommended planting rate is 1,000 lb per acre of tubers which yield up to 10,000 to 15,000 plants per acre. Ideal planting time is spring through early summer (January to March). Ideal spacing is 12 to 25 inches between plants and 30 to 35 inches between rows at a planting depth of 2 to 4 inches. Tubers begin to form in August.

Fertilization

Fertilizer application helps produce a better yield. Fertilizer requirements of Jerusalem artichoke plants are same as that of potatoes. Generally it is suggested that 500 to 700 lb per acre of 6-12-6 NPK should be broadcasted in the row. This rate may be increased on low fertile soils.

Irrigation

Sunny position and water are two essential requirements for the successful production of Jerusalem artichokes. Jerusalem artichokes need to be watered deeply to force the production of large tubers. Less watering tends to produce less and smaller tubers.

Weed Control

Mechanical weed control is generally recommended for Jerusalem artichokes. Manual removal of weeding, by carefully pulling of any weeds that appear, until the plants get well established is highly recommended.

Disease Management

Sclerotinia rot is a major problem in Jerusalem artichoke. Other fungal diseases that affect Jerusalem artichoke include downy mildew, rust and southern stem blight. Since there are no major registered chemicals recommended for Jerusalem Artichokes, biological control methods may be adopted for disease control.

Insect Pest Management

Puccinia helianthi is the most serious pest that attack Jerusalem artichoke plants. Burning the tops of the plants and a change of locality is recommended for the absolute control of the pest.

Aftercare

Since Jerusalem artichoke plants remain dormant during winter season, cut the flower stalks off at the ground level in order to help this vegetable survive the winter. Then cover the plants with proper mulching to protect them from frost injury. Mulch can be removed during spring season.

Harvesting

Harvesting of Jerusalem artichokes is similar to that of potatoes. Manual harvesting using a modified potato digger is generally advised as the best option. Harvested tubers are stored in gunny/jute bags and transported immediately to pack houses to avoid damage of the tubers due to field heat.

Harvesting time

Ideal harvesting time is fall through early winter (November to January), when the foliage begins to change color. Harvesting should be done in early hours of morning to avoid extreme heat building in tubers.

Harvesting method

Tops should be cut down to 12" above the ground with a mower and then plough open the furrow, pick up the tubers, place in field containers or jute bags, and remove the harvested produce from the field immediately. Harvest the tubers in 4 or 5 months as it is best to leave them in the soil and harvest as and when needed.

Yield

Average tuber yield ranges between 5 and 10 tons per acre. Alcohol yield is at 60–100 liters/metric tons of tubers. Yield of tops for forage is between 10 and 15 tons per acre.

Post Harvest Handling

Since the skin of Jerusalem artichokes is very thin, care should be taken during post harvest handling of the tubers to avoid skinning, cuts and bruises. The skin is also susceptible to rapid moisture loss so the harvested produce should be put in storage immediately after harvest.

Storage

Ideal cold storage conditions include a storage temperature of 32 to 34°F and a very high humidity (85 to 95% relative humidity). Under these conditions, tubers can be kept for several months. Optimum Storage temperature for Jerusalem artichoke is 0.5- 0°C or 31 - 32 °F. Relative humidity is 90 – 95 %. Estimated storage life is 4 months.

Packaging

For bulk marketing, gunny bags or jute bags are generally used for packing Jerusalem artichoke tubers. Perforated polyethylene bags are used for packaging the tubers for retail marketing. For long term storage in cold storages, tubers are peeled and sliced before placing in cold water with lemon juice for preventing discoloration. Thereafter sliced tubers are blanched in boiling water for few minutes and then cooled and dried before freezing them for half an hour. Frozen tubers are then packed in air tight bags before sealing and labelling them. These frozen Jerusalem artichoke tubers can be stored up to 6 months.

Marketing

Tubers are marketed as fresh produce as well as processed products. Fresh Jerusalem artichoke tubers are generally available in the market from November to April. Processed and frozen tubers are available at any time.

Uses of Jerusalem Artichoke

Food purposes

Jerusalem artichoke is mainly cultivated for its underground tubers which are edible and are used as root vegetables. Raw tubers resembles potatoes in consistency and texture but more sweet and nuttier in flavor. Tubers have a crispness that resembles water chestnuts and therefore most suitable for salad preparation. Jerusalem artichokes are used for pickling purposes and can also be cooked like potatoes. Thin slices of tubers are used for preparing chips. The foliage of Jerusalem artichoke plants makes a good forage crop for the livestock. Stems and leaves are rich in fats, protein and pectin, and make good forage and silage.

Sugar production

Jerusalem artichokes store carbohydrates in the form of inulin and are an important source of fructose. Since tubers are rich in fructose, tubers may be used for sugar extraction though these tubers are not yet commercially exploited for sugar production.

Alcohol production

Jerusalem artichoke tubers are widely used in France, Germany and many other European countries for producing alcoholic beverages including beer and wine. Jerusalem artichoke has a high content of easily hydrolyzed inulin and hence may be used for ethanol production. But a detailed research is needed for formulating an economically viable method for ethanol extraction from Jerusalem artichoke tubers.

Medicinal properties

Though most of the root tubers store carbohydrates as starch, Jerusalem artichokes and other artichokes store carbohydrates as inulin. Therefore Jerusalem artichoke tubers serve as the best substitutes for starches in many diet preparations. Besides, inulin is easily digestible and helps body in increasing calcium absorption. Another important point is, consumption of Jerusalem tubers does not increase blood sugar and therefore highly recommended for the diabetic patients as a part of their regular diet and hence it is also known as '*diabetics potato*'. Jerusalem artichoke can also be used as an aphrodisiac, diuretic, stomachic, and tonic, Jerusalem artichoke is also used as a remedy for rheumatism.

Economics of Production

Cost of production of Jerusalem artichoke tubers varies depending upon locality, soil type, and other relevant parameters. However it is estimated that on an average, USD (US Dollars) 1400 to 2000 is spent toward the production of approximately 10 tons of tubers from an area of one acre. An estimated economics for the production of Jerusalem artichoke crop per acre area is as shown in Table :

Jerusalem artichoke: economics of production per acre	
Parameters	Estimated Cost
Cost of seeds/tubers	\$1000/acre
Cutting and planting	\$60 to 150/acre
Cost of cultivation	\$25 to 50/acre
Cost of harvesting	\$250 to 400/acre
Miscellaneous	\$100 to 300

- All figures are in dollars

- Miscellaneous expenses include storage, transportation and supplemental seed stock

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Or

Contact us at

info@agrihortico.com

agrihortico@gmail.com

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