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# STORAGE, DRYING AND PROCESSING OF JERUSALEM ARTICHOKE TUBERS IN THE CONDITIONS OF ZARAFSHAN VALLEY

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**ABSTRACT**
Targeted cultivation of Jerusalem artichokes for storage, drying, processing using agro-technologies, storage methods, drying technology have been improved, it is recommended to include Jerusalem artichokes and powders in the food balance through the preparation of dietary products.

**INTRODUCTION**
Changes in the forms of ownership in agriculture, the organization of production as a new value chain, the introduction of a single cluster system of landowners, producers, storage, logistics and primary processing enterprises, the cultivation, storage, processing and marketing of products The production system is implemented in cotton, grain and vegetables. It is an industrial of agricultural production and processing. In other words, it is an industrialized system, which creates an opportunity to increase the profitability of the industry by owning the product, delivering the product to the market, to the consumer. [1;119-p].
Jerusalem artichoke is promising and versatile, first developed by academician NI Vavilov in 1933 in Irkutsk (1990), Odessa (1991), Voronezh (1992) and Tver (1999, 2006). recorded at conferences. Similarly, the International Congresses held in South Korea (1983) and the Netherlands (1991) noted that the issue of developing innovative technologies for the cultivation of various products using Jerusalem artichokes was raised. [5;28-p].
At the First International Congress, it was recognized that Jerusalem artichoke has a large biomass and can be used as an energy resource, and its stems and stems are cheap raw materials for the production of ethanol and a substitute for oil, natural gas and coal. [2; 160-p.].
At present, the biological activity of Jerusalem artichoke (immunostimulant, antioxidant, adaptogen, anti-stressor, etc.) has been proven in many studies. Due to the importance of Jerusalem artichoke in fructose production, it has been called a 21st century plant at international conferences. [3; 161-p., 5; 28-p., 4; 83-p.].
Resolution of the Cabinet of Ministers of the Republic of Uzbekistan dated January 19, 2015 No №5 "On measures to develop the forestry system, further expand the cultivation and processing of medicinal and food raw materials in 2015-2017" 58 in 2015, 86 in 2016 and In 2017, 112 hectares were planted and instructed on processing. This is now being done with its positive results. [10; 5-p ]
In recent years, a number of varieties of artichokes Fayz-baraka, Mujiza, Etiraf have been created in Uzbekistan, and their industrial industry is being formed. The availability of newly created varieties, the launch of processing plants for stalks and stalks, the improvement of plant growing technology, the need for raw materials for processing enterprises. Jerusalem artichoke is also used as a technical crop to obtain fructose by hydrolysis of inulin in its stems. Ethyl alcohol, wine and wine vinegar, yeast, beer and other products are also obtained from the bottles. [6; 41-p 7; 5-p 8; 60-p; 11; 128-p ].
In view of the above, the lack of targeted programs for storage, drying and processing of artichokes in the Zarafshan Valley, the need for dietary products in the daily consumption of the population, especially the elderly, the need for year-round consumption, the introduction of new technological processes in processing plants. preparation of various products is not regulated.
In this regard, we have been working since 2017 on the development of recipes for the preparation of various local dietary products (pure Jerusalem artichoke marinade, puree powder, complete chips) We are conducting research in collaboration with SP OOO AGRO-MIR KONSERVA located in Samarkand region Samarkand

## THE AIM OF THE RESEARCH

Is to study the methods of storage and drying of artichokes grown for food, to develop a scientifically based recipe for processing and to make recommendations for inclusion in the food balance.Тадқиқотлар олдига қуйидаги вазифалар қўйилди:

-study of methods of storage of different varieties of Jerusalem artichoke;

-study of methods of drying the ends of different varieties of Jerusalem artichoke;

-Jerusalem artichoke consists of making recommendations for the primary processing of the ends of different varieties (end chips, canned, pickling) and their inclusion in the food balance.

- To determine the cost-effectiveness of storage, drying and processing of Jerusalem artichoke varieties.

According to GOST-17.13.04, the Ministry of Agriculture of the Republic of Uzbekistan, the State Testing Commission for Agricultural Varieties of the Republic of Uzbekistan, the method of drying the tubers, the preparation of canned food, the production of powder and chips. GOST 17.23.02 GOST-26313, preparation of samples GOST-26671, GOST 26929, final composition, mineral mixtures GOST-8756.1; GOST 25555.3, microbiological analysis was carried out on the basis of GOST 2668 methods.

The nutrient content of the varieties was determined by the M.F. Tomme method, protein nitrogen was determined by the Keldall method and multiplied by 5.7 (N> 5.7), protein by the Barnstein method, fat in the Soxlet apparatus, fiber by Shtaman and Gennebberg, AEM and ash by A.I. Ermakov, the amount of dry matter is determined by the method of weighing, by the method of sugar-Bertrand, the amount of ascorbic acid and carotene is determined by the method of I.K. Murri;

## RESEARCH RESULTS AND THEIR DISCUSSION

Determination of the chemical composition of artichoke tubers showed that the quality preservation of carbohydrates, vitamins, macro-and micronutrients in the tubers, even when dried, showed that they have a high potential for processing.

The chemical composition of the tubers grown in different soil climatic conditions of the Zarafshan valley was analyzed.

The quality of food, its suitability for processing, the preservation of its chemical composition depends in many respects on the conditions of its cultivation, the agro-technologies used.

**The first** option-Sowing in the spring, the thickness of the bush 31.7 thousand bushes / ha (90x35 cm), nitrogen-250, phosphorus-180, potassium-150 kg / ha, the number of irrigations 6-8 times, harvesting- in October, the topsoil separately, The finish is for separate food and processing.

**The second** option - Sowing in the fall, the thickness of the bush 55.5 thousand bushes (60x30 cm), nitrogen-300, phosphorus-200, potassium-150 kg / ha, the number of irrigations 8-10 times, harvesting- in September the topsoil is completed together with silage.

For the food industry and the pharmaceutical industry, the amount of inulin in the finished product was taken as the basis.

Inulin content was 9.5-10.1% in the lowlands and 11.5-11.7% in the foothills. or 2.2-2.5% higher than in the plains and 0.5-0.6% higher than in the foothills (Table-1).

1-Table. Biochemical structure sort of Etirof

| № | Growing technology | The ends are average weight, g | Dry matter, % | Sugar,% | Inulin,% | Askarbin acid, mg / 100 g | Starch% | Protein,% |
|---|---|---|---|---|---|---|---|---|
| **Navoi region, plain area, typical glacial soils** | | | | | | | | |
| 1 | 1st option | 105,2 | 23,5 | 1,3 | 9,5 | 3,9 | 54,6 | 7,2 |
| 2 | 2nd option | 83,4 | 23,1 | 1,1 | 10,1 | 4,0 | 54,3 | 7,4 |
| **Samarkand region, mountainous area, meadow gray soils** | | | | | | | | |
| 3 | 1st option | 98,3 | 20,8 | 1,0 | 11,5 | 3,9 | 55,0 | 7,8 |
| 4 | 2nd option | 79,0 | 20,6 | 0,7 | 11,7 | 4,0 | 55,1 | 7,9 |
| **Jizzakh region, mountainous area, meadow soils** | | | | | | | | |
| 5 | 1st option | 80,6 | 19,2 | 0,8 | 12,0 | 4,0 | 55,4 | 8,0 |
| 6 | 2nd option | 75,9 | 19,3 | 0,7 | 12,3 | 4,1 | 55,5 | 8,1 |

Depending on the intended use of artichoke tubers, agrotechnology of varieties has been developed, taking into account the suitability for processing in accordance with the requirements of the food and pharmaceutical industries, it is advisable to grow Jerusalem artichokes for food.

Jerusalem artichoke has a yield of 38-40 tons per hectare in typical gray soils, 34-36 tons per hectare in meadow gray soils and 28-32 tons per hectare in mountainous conditions with meadow gray soils. Depending on the amount of dry matter in the tubers, an average of 1 kg of powder is obtained from 7-8 kg of tubers. Experiments have shown that under typical gray soils, 7 kg of powder is obtained from 7 kg in the plains, 7.5 kg when grown in the foothills of the gray soils, and 8 kg to 1 kg in the soils grown in the mountain meadows. At the same time, 5.2-5.7 per hectare in terms of regions; 4.5-4.8; 3.7-4.0 tons of powder can be obtained. When studied in terms of their quality and content of inulin, they are of particular importance as a raw material for the food industry and pharmaceutical industry from the tubers grown in grassy soil conditions in mountainous areas.

The experiments studied the degree of weight change, deterioration of quality and basic natural weight change of artichokes of Fayz Baraka, Mujiza and Etiraf varieties of Jerusalem artichoke, leaving them in the usual field and stored in a special warehouse and modern refrigerators. At the same time, a significant change in the weight of the seedlings was observed in the experimental options. Jerusalem artichoke varieties are planted in the spring with a bush thickness of 31.7 thousand bushes (90x35 cm) and harvested in the fall of this year and stored in warehouses for 5 months at -0 + 30S. %, diseased limbs accounted for 1.4%, and in the Mujiza species 11.2%, 3.0%, and 2.0%, respectively. The natural extinction of these varieties was 8.6% in Fayz Baraka, 3.4% in mechanical damage, 2.8% in disease, and 8.9%, 4.3% and 2.7% in Mujiza. (Table-2).

In the case of Fayz Baraka, natural withering is 5.5%, in the spring it is 12.9%, in the spring it is 6.7%, and in the Mujiza it is 6.1%, 13.2% and sick. weight was found to be 3.9%.

Natural weight loss for five months when stored at -1 + 10C in special modern refrigerators (chambers) - 2.8%, and the proportion of mechanically damaged ends was noted to be 1.6-1.8% on average by cultivars.

When planting Jerusalem artichoke varieties in spring, 31.7 thousand bushes / ha (90x35 cm) and harvested in autumn, their loss in various ways for five months. 20.1%, and in the Recognition category it was 10.7-18.6%.

Jerusalem artichoke varieties are sown in autumn, the thickness of the bush is 55.5 thousand bushes / ha (60x30 cm). 13.3-25.7% in the genus and 12.9-21.0% in the genus of confession.

Depending on the method of cultivation, Jerusalem artichoke varieties are planted in early spring with a bush thickness of 31.7 thousand bushes / ha (90x35 cm). When planting, the thickness of the bush is 55.5 thousand bushes / ha (60x30 cm), and when storing the crop in the fall of next year, the loss varies by 9.9-10.4%, or 2.1-2.4% by variety. was found.

Table-2 Varieties of Jerusalem artichoke varieties resilience in methods

| № | Storage methods | Varieties | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Fayz baraka** | | | | **Mujiza** | | | | **Etiraf** | | | |
| | | total destrtion,% | hence | | | total destrtion,% | hence | | | total destrtion,% | hence | | |
| | | | natural fade,% | mechanical damage,% | sick, % | | natural fade,% | mechanical damage,% | sick, % | | natural fade,% | mechanical damage,% | sick, % |
| | | **Sowing in the spring, the thickness of the bush is 31.7 thousand bushes / ha (90x35 cm)** | | | | | | | | | | | |
| 1 | Leaving in the field | 19,5 | 4,5 | 10,4 | 4,6 | 20,1 | 4,2 | 11,4 | 4,5 | 18,6 | 3,9 | 11,2 | 3,5 |
| 2 | in the pit | 14,7 | 6,5 | 4,8 | 3,4 | 13,4 | 5,8 | 4,9 | 2,7 | 14,0 | 5,4 | 5,2 | 3,4 |
| 3 | In Natural storage facilities | 15,4 | 9,9 | 3,0 | 2,5 | 13,8 | 8,9 | 2,8 | 2,1 | 13,7 | 7,8 | 2,6 | 3,3 |
| 4 | In refrigerated chambers, -1+1 | 8,3 | 4,3 | 2,4 | 1,6 | 8,2 | 4,1 | 2,3 | 1,8 | 7,5 | 3,4 | 2,5 | 1,6 |
| 5 | In refrigerated chambers +2+3 | 10,4 | 5,7 | 2,6 | 1,9 | 9,1 | 4,6 | 2,5 | 2,0 | 8,2 | 3,6 | 2,8 | 1,8 |
| 6 | In refrigerated chambers | 11,2 | 6,5 | 2,7 | 2,0 | 11,0 | 6,5 | 2,5 | 2,0 | 10,7 | 5,6 | 2,9 | 2,2 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | +3+4 | | | | | | | | | | | | |
| | | Planting is in the autumn, the thickness of the bush is 55.5 thousand bushes / ha (60x30 cm) | | | | | | | | | | | |
| 1 | Leaving in the field | 25,3 | 4,9 | 12,3 | 5,1 | 25,7 | 4,8 | 13,0 | 5,9 | 21,0 | 4,8 | 12,0 | 4,2 |
| 2 | in the pit | 16,1 | 7,2 | 5,1 | 3,8 | 14,6 | 6,3 | 5,1 | 3,2 | 15,4 | 6,4 | 5,4 | 3,6 |
| 3 | In Natural storage facilities | 17,3 | 10,3 | 3,9 | 2,8 | 16,4 | 9,6 | 4,0 | 2,8 | 17,3 | 10,0 | 3,5 | 3,8 |
| 4 | In refrigerated chambers, -1+1 | 10,4 | 5,9 | 2,8 | 1,7 | 11,1 | 6,2 | 2,8 | 2,1 | 9,9 | 5,0 | 3,0 | 1,9 |
| 5 | In refrigerated chambers +2+3 | 11,5 | 6,4 | 3,0 | 2,1 | 10,4 | 5,4 | 2,7 | 2,3 | 10,0 | 4,7 | 3,3 | 2,0 |
| 6 | In refrigerated chambers +3+4 | 13,9 | 7,9 | 3,6 | 2,4 | 13,3 | 7,8 | 2,9 | 2,5 | 12,9 | 6,8 | 3,5 | 2,6 |

In terms of methods of cultivation and storage of tubers, the highest mortality was recorded in 19.5-25.3% when the tubers were left in the field without digging, and the lowest in 7.5-9.9% when stored in refrigerated chambers at -1 + 1.

Thus, the purposeful use of tubers of artichoke varieties, storage of commercial and seed tubers in special modern refrigerators (chambers) prevents their loss of commodity and seed qualities, allows the use of tubers at any time and for any purpose.

Jerusalem artichoke varieties are planted in the spring with a bush thickness of 31.7 thousand bushes (90x35 cm) and harvested in the fall of this year and stored in warehouses for 5 months at -0 + 30S. %, diseased limbs accounted for 1.4%, and in the Mujiza species 11.2%, 3.0%, and 2.0%, respectively. The natural extinction of these varieties was 8.6% in Fayz Baraka, 3.4% in mechanical damage, 2.8% in disease, and 8.9%, 4.3% and 2.7% in Mujiza. (Table-2).

In the case of Fayz Baraka, natural extinction is 5.5%, in the early spring, 12.9% of injuries and 6.7% of cases are observed before digging, and in the Mujiza variety, the rate is 6.1%, 13.2% and the number of cases is higher. weight was found to be 3.9%.

Loss of natural weight for five months when stored in a special modern refrigerator (chambers) at -1 + 10C degrees Fayz Baraka variety 4.3%, Mujiza variety 4.1%, Confession variety 3.4%, diseased part of the tubers 2.5 -2.8%, and the proportion of mechanically damaged ends was noted to be 1.6-1.8% on average by cultivars.

When planting Jerusalem artichoke varieties in spring, 31.7 thousand bushes / ha (90x35 cm) and harvested in autumn, their loss in various ways for five months. 20.1%, and in the Recognition category it was 10.7-18.6%.

Jerusalem artichoke varieties are sown in autumn, the thickness of the bush is 55.5 thousand bushes / ha (60x30 cm). 13.3-25.7% in the genus and 12.9-21.0% in the genus of confession.

Depending on the method of cultivation, Jerusalem artichoke varieties are planted in early spring with a bush thickness of 31.7 thousand bushes / ha (90x35 cm). When planting, the thickness of the bush is 55.5 thousand bushes / ha (60x30 cm), and when storing the crop in the fall of next year, the loss of varieties varies by 9.9-10.4%, or 2.1-2.4%. was found.

In terms of methods of cultivation and storage of tubers, the highest mortality was recorded in 19.5-25.3% when the tubers were left in the field without digging, and the lowest in 7.5-9.9% when stored in refrigerated chambers at -1 + 1.

Thus, the purposeful use of tubers of artichoke varieties, storage of commercial and seed tubers in special modern refrigerators (chambers) prevents their loss of commodity and seed qualities, allows the use of tubers at any time and for any purpose.

**Experiment 2.** Study of methods of drying Jerusalem artichokes. Fayz baraka, Mujiza, Etiraf varieties, in each variant from 10 kg to 40-60 grams are taken. Repeats 4.

-drying at room temperature 18-20 $^0$C for 48 hours;

-in the drying cabinet 36 hours 28-30 $^0$C;

-in the drying cabinet 24 hours 38-40 $^0$C;

- in the drying cabinet for 12 hours at 48-50 $^0$C;

-Drying oven for 3 hours at 68-70 $^0$C.

Determining the chemical composition of Jerusalem artichokes showed that the quality storage of carbohydrates, vitamins, macro and micronutrients, even when dried, showed the possibility of using them in processed form.

It has been found that vacuum drying (sublimation) is a convenient way to cut Jerusalem artichokes into the same size and drying, and that the same method of drying the tubers and keeping the dried mass without powder is a convenient method.

It is recommended to dry the powder in a drying cabinet at + 68 + 70 degrees for three hours and store the powder in a glass jar after grinding. In Jerusalem artichoke varieties, depending on the amount of dry matter, an average of 1 kg of powder is obtained from 7-8 kg of tubers. It was determined that 8 kg of powder was obtained from Fayz Baraka, 8.5 kg from Mujiza and 7.5 kg to 1 kg from Etiraf.

A convenient way to use Jerusalem artichokes is to pickle the cabbage with cucumbers, cucumbers, tomatoes at home, dry the crushed onions in the kitchen oven (microwave), grind them, add the powder to the diet dough, make coffee.

The inclusion of newly created varieties in the food balance, their initial and complete processing is being introduced. The stems and leaves of the plant are rich in vitamins, the amount of dry matter reaches 25-30 percent. It is rich in digestible carbohydrates and low in klechatka. The amount of riboflavin in the green mass of Jerusalem artichoke is 1.75 mg / kg, 1.9 mg at the end, nicotinic acid is 8.3 and 18.8 mg / kg, respectively. Its green mass is also rich in B vitamins. The chemical composition of leaves, stems and stems of Jerusalem artichoke varieties is given in Table 3.

Biochemical composition of leaves, tubers and stems of Jerusalem artichoke varieties

| № | Variety and samples | The plant | Date of analysis | Protein, % | Cellulose, % | |
|---|---|---|---|---|---|---|
| | | | | | In the dry state | In the wet state |
| 1 | Mujiza | Leaves | 28.08 | 16,9 | 20,0 | 3,8 |
| | | Stems | 28.08 | 3,7 | 25,0 | 6,0 |
| | | Tubers | 20.10 | 7,6 | 0,7 | 1,5 |
| 2 | Fayz baraka | Leaves | 28.08 | 17,2 | 19,0 | 4,2 |
| | | Stems | 28.08 | 3,9 | 24,0 | 5,9 |
| | | Tubers | 20.10 | 8,1 | 0,9 | 1,6 |
| 10 | Etiraf | Leaves | 28.08 | 17,3 | 22,0 | 4,5 |
| | | Stems | 28.08 | 4,9 | 26,0 | 6,8 |
| | | Tubers | 20.10 | 7,6 | 0,7 | 1,9 |

Jerusalem artichoke as a food crop. In ancient times, the Indians prepared a variety of salads from the young grasses and leaves of the earth pear. The ends were used freshly harvested and dried. Nowadays, the food is mainly used whole grains. Contains (mg,% of dry matter) iron-11; manganese-43.0; calcium-75.6; magnesium-32.0; potassium-13.5; sodium-17.2; silicon - up to 8%. Tuganak contains protein, pectin, amino acids, organic and fatty acids. Pectin occurs in up to 11%. Vitamins B1, B2, C are partially higher than in potatoes, 3 times higher than in carrots and beets. Jerusalem artichoke contains 8 different amino acids up to 3.2%, which are synthesized only by the plant. These are arginine, valine, histidine, isoleucine, leucine, lysine, methionine, tryptophan and phenylalanine.

The ends are rich in carbohydrates, with an average dry matter content of 48.31% relative to dry matter and 11.4-12.5% relative to wet weight.

In clinical trials, patients with diabetes mellitus who received "inulin" (type 1 and 2) had a decrease in blood and urine sugar levels by 16-17%, while inulin-receiving patients had a decrease in inulin intake by 12-13 units.

Jerusalem artichokes can be used to treat atherosclerosis, tachycardia, hypertension, thrombophlebitis, anemia, tuberculosis, ulcers, diarrhea, osteochondrosis and many other diseases, in addition to diabetes.

Medicines are being developed for patients with diabetes in the population. For example, Dolgolet, Inulin, Glustab and Oribet tablets were produced. In addition, "Jerusalem artichoke (dried powder)" in several

different forms and sizes was put up for sale. Even at home, you can take the powder from the top of the artichoke and use it at any time in tea, coffee, or pastries, adding it to the dough when making diet bread.

## JERUSALEM ARTICHOKE-HONEY PLANT

The duration of the flowering period of the Jerusalem artichoke plant is long, 55-60 days, and the flowers begin to open early in the morning. The bees' journey to the baskets lasted until sunrise until evening. 1050 bees were observed in the morning from 600-12 00 and 1860 in the late 1900. The opening of one basket lasts 3-4 days, the 3rd day of the opening of the flower was observed. Up to 0.5-1 mg of nectar is stored in each flower. According to the analysis, 40-70 kg of honey can be obtained from the fields planted with Jerusalem artichokes per hectare.

In the experiments, the tops of 3 varieties were studied as pure marinades, which meet the requirements of preservation, taste, appearance and inclusion in the food balance.

## CHIPS PREPARATION

The ends of the 3 varieties studied in the experiments were sorted to 60-80 grams of the same size. The tubers were washed clean and cut into thin slices and fried in hot sunflower oil in a special grid pan.

Table-4. Orgonoleptic characteristics of the product, based on a 9-point scale

| № | Indicator name | Description, indicator score | | |
|---|---|---|---|---|
| | | Файз барака | Мўжиза | Эътироф |
| 1. | Appearance and consistency, point | **7** | **7** | **6** |
| 2. | Taste and smell, point | **7** | **8** | **7** |
| 3. | Colour, point | **6** | **7** | **6** |
| 4. | Breaking degree, point | **5** | **6** | **5** |

Preparation of pasta pieces made from artichoke powder with hard wheat flour also gave positive results.

## CONCLUSION

In summary, the introduction of a single cluster system of storage, drying and processing of Jerusalem artichokes on the basis of targeted cultivation technology with the right selection of varieties for high and quality crops, the formation of a highly profitable network, the production of food products that meet consumer demand in local conditions opportunity is created.

We recommend to develop methods of storage and processing of new varieties of Mujiza and Confession in the cluster system and to include them in the food balance for delivery to the consumer in the form of chips, fresh marinades and various pickles from artichoke tubers.

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