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PRICKLY *ARTICHOKE - CYNARA SCOLYMUS L. IS A PERSPECTIVE PLANT FOR THE PHARMACEUTICAL INDUSTRU OF UZBEKISTAN*

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In the article there has been given information about the results of conducted researches on developing technology of growing Prickly Artichoke in the soil-chmattc conditions of the Samarkand and Tashkent regions of the Republic of Uzbekistan. In this work there has been paid a great attention to conduct agro technical measures, such as terms, standards, schemes and depth of sowing, terms and standards of using mineral fertilizers, irrigation scheme and etc. Besides that, in this article there have been given facts about possibility of rising quantity of bioactive substances in the raw material by phosphorus ensuring the soil and using ammonium sulphate which help plant to grow, develop and raise its yield capacity.

Keywords: Prickly Artichoke, protein, carbohydrates, inulin, vitamins, cellulose, calcium, iron, magnesium, nucleinic acids, amino acids, nitrates, sulphur.

Goal**.** Sort Cynara L. (Artichoke) belongs to Asteraceae family and includes 11 types long-term, the rod rooted of grassy plants. Types of this sort are widely spread in flora of the countries located along the Mediterranean Sea, the Canary Islands and South America. Ethiopia, where it has extended to Egypt, the countries of the Mediterranean Sea and to Europe is considered the homeland of an artichoke. Some types grow in Western Europe and Central America. The most known of this sort of Cynara scolymus L. – the artichoke prickly was used by a man in 800 years B.C.

In the first references of cultivation of an artichoke prickly it is noted that ancient Greeks widely used this plant as in cookery and medicine, noting its high flavouring and medical qualities. Now two types cultivated. Spanish artichoke, Cynara cardunculus L. named Kardon. This type is considered more ancient. From this type there was an artichoke prickly - Cynara scolymus L. The culture of the last is widespread in many countries of the world now and there are numerous grades, with big sizes of baskets and without prickles. Kardon considerably differs from the cultivated artichoke prickly in more powerful size of a bush and leaves, but considerable the smaller size of baskets.

In Russia the artichoke prickly is brought from Holland as herb according to the Decree of Peter I in 1715 to St. Petersburg and was cultivated in estates and kitchen gardens of boyars and merchants and other honourable men. By 1830 about 32000 tons of this plant were grown up in Russia. Spaniards have brought to America culture of an artichoke prickly and through Mexico this plant successfully cultivated in Chile Peru, Brazil, Argentina and in the 19th century in the USA.

In Azerbaijan the artichoke prickly was cultivated in 1914 for the first time as an ornamental plant, and since 1943 as valuable vegetable.

Experiments on cultivation of an artichoke prickly have been begun in the 70th years of last century in Uzbekistan [3].

However so far in Uzbekistan the artichoke prickly was grown up only by certain gardener fans on personal plots and certain individuals for gardening and arrangement of bouquets. The young scientist Nomozov Z.B., from the Samarkand State University in recent years conducted successful researches of bio ecological features of the cultivation of an artichoke prickly in irrigation and not irrigation conditions of the Samarkand region and framed small experienced sites for receiving seeds of this valuable plant of a local reproduction [3].

Kardon cultivated for the sake of his juicy, fleshy petiole of large radical leaves. They are used as vegetable culture like chicory, fennel and rhubarb. However, Kardon's production – the bleached fleshy petiole of large radical leaves in the market meet not often.

The culture of an artichoke prickly got into Europe in the 15-16th centuries. Artichoke prickly – a perennial grassy plant is 2 m of height. Stalks are upright, trimmed, grey – whitish. Leaves are simple, pinnately dissect, with bladed or gear segments, up to 1 m long sometimes on edge prickly: from below trimmed, green or glaucous. Baskets 10 - 15 cm wide with a fleshy receptacle and prickly leaflets of a wrapper large, juicy sometimes. Flowers in a basket are a lot of, regional flowers blue, darkly blue, in a false manner lingular: median - yellow, tubular. Achenes are large, tetrahedral, brilliant, gray with dark strias or speckled with a firm shell. The weight of 1000 pieces is 45 - 55 g. The wide circulation of culture of an artichoke prickly world in many countries was promoted by demand for this plant with unique chemical composition of its inflorescences (baskets) not only as valuable vegetable delicacy, but also many medicinal properties.

Chemical composition of baskets of an artichoke prickly contains to 3% of protein, 7-15% of carbohydrates, an inulin, disaccharides, 4-11 mg of % of vitamin C, fat, Thiaminum (B1), beta Carotinum, Riboflavinum (B2), Niacinum (B3), pyridoxine (B6), tocopherol (vitamin E) pantothenic acid (B5), vitamin K, calcium, iron, magnesium, phosphorus, potassium, sodium, Zincum manganese, etc. [3,8]. Leaves of an artichoke contain glycosides – derivatives of a lyuteolin – cyanoside, skolimozidium and cyanotzid; phenocarbolic acids (coffee, chlorogenic, non-chlorogenic, 4-o-kofesil - kofeil - D – quinic acid. Besides as a part of a plant are found glycol and glyceric acid [4,7]. Thanks to existence of Cinorinum the plant is very useful for elderly people and a sick atherosclerosis [5]. In many countries of the world for the last decades from leaves of an artichoke numerous drugs are received. At first on animals in experiment, and then and in clinical tests their diuretic, bile-expelling and hypo chemical cholesterol action is confirmed.

Preparations of an artichoke are applied to treatment of jaundice (especially at children), cholelithiasis, hepatitis, an endarteritis and atherosclerosis. Doctors successfully apply artichoke preparations to treatment of an allergy (the small tortoiseshell, serumal illness and etc.), some forms of psoriasis and eczemas. The artichoke is shown in before - and after the operational period to the

patients who have undergone to transactions on a liver and kidneys [5]. Extract of an artichoke and cynarine at people and animals in case of intake has the expressed choleretic effect, increasing dry remaining balance and content of cholesterol in bile. Extract causes increase in diuresis and a concentration capability of kidneys, azotemia and improvement of a general condition in patients with an azotemia [5].

Attraction in industrial culture of the plant of artichoke, new, little-known for the Republic of Uzbekistan, prickly is very actual and perspective.

Methods of research. Experimental works on studying the influence of various forms and doses of nitrogen fertilizers on growth, development and productivity of an artichoke prickly carried out during 2011-2016 on pilot sites of the Samarkand State university (600 sq.m), the Tashkent Pharmaceutical Institute (200 sq.m) and at experimental station of the Tashkent State agricultural university (420 sq.m).

Soils where pledged small pushed plot experiences, are the old irrigated typical gray soil.

The purpose of researches was comparative studying of extent of use by an artichoke prickly various forms and doses of nitrogen fertilizers and their influence on processes of growth, development, productivity, on biosynthesis of photosynthesizing pigments, nucleinic acids, amino acids, albumens, carbohydrates, contents of fractional composition of water and eventually on biosynthesis of biologically active agents in raw materials of an artichoke prickly. The agro technology on pilot sites consisted of the following transactions: plowing (fall) with layer turnover, a chiselling, two multiple bushing up and down a site. The agrochemical characteristic of the arable and subarable horizon of a typical gray soil on pilot sites following: nitrogen respectively 0,10 and 0,07%, humus of 1,1 and 0,7%, phosphorus of 0,16%, mg/kg nitrates 15 and 20, mobile phosphorus and exchange potassium 32,0 and 208 of mg/kg. In experiences the following types of fertilizers were applied: ammonium nitrate – 34% of nitrogen, urea – 46% of nitrogen, ammophos – 41% of nitrogen, ammonium sulfate with content – 24,2% are gray and 21% of nitrogen, chloride potassium - 60% of K20.

Doses of application of fertilizers: N = 100, 150 and 200 kg/hectare,

P = 75, 110 and 140 kg/hectare,

To = 50, 75 and 100 kg/hectare.

Terms and acceptances of introduction of nitrogen fertilizers:

30% - in the spring before vegetation of plants;

35%) - before budding of plants;

35% - before blossoming;

P – it is completely brought in the fall;

To – it is brought in two steps: in a phase of budding of 50% and during blossoming of 50%.

Phonological supervision over growth and development were carried out by the commonly accepted technique [1]. In separate phases of development of an artichoke prickly determined dry weight [2].

Results of research. Now scientific SAMGU, TASHFARMI and TashGAU are engaged in

development of technology of cultivation of an artichoke prickly for creation of plantations and receipt of high-quality vegetable raw materials for domestic pharmaceutical industry. By us it is by practical consideration found that the artichoke seeds stored in vitro in paper packets, in case of the air temperature of +15+18 °C have kept field viability till 9 years of 90% (tab. 1). Optimum sowing time is found: February-March.

1 table

The influence of sowing time of Cynara scolymus L. on field viability of seeds

Term of sowing	Quantity of grew up seeds 1m/square			
	In the condition of sowing		Not sowed	
	Pcs	%	Pcs	%
20.10.2010	156	78	148	74
15.11.2010	150	75	142	71
20.02.2011	165	82,5	154	77
10.03.2011	180	90	160	80
01.04.2011	140	70	135	67,5

For pharmaceutical raw materials it is necessary to develop agro technical actions for receipt of big crops of leaves of an artichoke and determination of terms of their procurement, especially in respect of application of different types of fertilizers and terms of watering. For this purpose we needed to conduct a number of researches on physiology, biochemistry and agro chemistry of an artichoke on an experimental plantation in field conditions.

Results of these researches are given in tab. 2, 3, 4.

Regulations of crops and their influence on safety a plant are revealed (tab. 2)

Table 2

The norm of crops (piece) of Cynara scolymus and their influence on safety of plants (%)

№	Norm of sowing	Quantity of seeds on 1м^2 square	Shoots		Safety of the shoots					
			Quantity	%	10IV	10V	10VI	10VII	10VIII	10IX
Watering										
1	4 kg/hectare	40	32,0	80	32/100	29/91	27/84	26/81	23/71	23/72
2	6 kg/hectare	60	51,0	85	52/100	46/92	43/86	41/81	40/78	40/80
3	8 kg/hectare	80	65,0	81	65/100	61/94	57/88	4/71	44/68	43/66

Without watering										
1	4 kg/hectare	40	30,0	75	30/100	27/91	23/77	20/67	17/56	17/56
2	6 kg/hectare	60	47,0	78	47/100	41/87	38/81	30/64	28/59	28/59
3	8 kg/hectare	80	65,0	81	65/100	62/96	54/86	38/66	32/49	30/46

Optimal depth of dressing of seeds was found (tab. 3).

Таблица №3

Germination of Cynara scolymus of seeds depending on seal depth

Depth of dressing of seeds (sm)		Quantity of grew up seeds			
		Watering		Without watering	
		pcs	%	pcs	%
1	On the surface of the soil	17,0	17	10,0	10
2	1	40,0	40	34	34
3	2	62,0	62	60	60
4	3	87,0	87	70	70
5	4	90,0	90	80	80
6	5	72,0	72	68	68

Subjected to the research the cellular juice which is squeezed out of the leaves of an artichoke which are previously recorded by hot steam prickly.

The size of oxidation-reduction potential Eh and pH value of cellular juice at above the called plant was determined on LPM-60M potentiometer with a glass electrode. As an electrode of comparison it used chlorine silver electrode.

Indicator rH_2 was calculated by the formula of Klark : $rH_2 = \frac{Eh}{30} + 2pH$

Results of researches demonstrate that dry seeds of an artichoke prickly as expected, don't find a difference of bioelectric potentials a germ - endosperms. They arise only at their swelling. Only after that (in 24-26 hours of swelling) the variation of seeds on electric polarity is observed. The potential difference during this period at an artichoke prickly depending on norms of nitrogen fertilizers varies from 2 to 42 mv.

PH values of cellular juice show that its active acidity at plants of artichoke prickly different options is various. It should be noted that if to try to establish connection between doses of nitrogen fertilizer of sulfate of ammonium and pH value of cellular juice, then accurate positive correlation is found between them. (tab. 4)

Table 4

Influence of various doses of sulfate of ammonium on physical and chemical properties of cellular juice of an artichoke prickly (pH, Eh, rH2)

№	Dose of sulfate	Фазы развития

	ammonium kg/hectare	2-3 present leaves	Budding	Flowering	Fruit formation	Maturation of seeds семян
pH						
1	Control (without fertilizer)	5,18±0,01	5,27±0,01	5,39±0,01	5,34±0,02	5,09±0,02
2	P+K (Фон)	5,21±0,01	5,32±0,02	5,43±0,02	5,37±0,02	5,14±0,01
3	$(NH_4)_2SO_4$ 100	5,29±0,01	5,37±0,01	5,48±0,02	5,43±0,01	5,18±0,01
4	$(NH_4)_2SO_4$ 150	5,36±0,02	5,40±0,01	5,52±0,01	5,48±0,01	5,29±0,01
5	$(NH_4)_2SO_4$ 200	5,38±0,02	5,41±0,02	5,53±0,01	5,49±0,01	5,30±0,01
Eh (mv)						
1	Control (without fertilizer)	152±2,01	159±1,20	163±1,26	161±1,21	147±2,17
2	P+K (Фон)	157±2,02	166±1,35	171±1,15	168±1,14	153±2,04
3	$(NH_4)_2SO_4$ 100	162±1,01	169±1,27	176±1,81	173±1,09	157±1,83
4	$(NH_4)_2SO_4$ 150	169±1,04	174±3,10	182±1,12	179±2,18	161±1,18
5	$(NH_4)_2SO_4$ 200	171±2,02	175±1,86	183±1,16	180±1,36	162±1,07
rH_2						
1	Control (without fertilizer)	15,43±0,17	15,84±0,22	16,21±0,14	16,05±0,16	15,08±0,14
2	P+K (Фон)	15,56±0,13	16,17±0,23	16,56±0,17	16,34±0,21	15,38±0,12
3	$(NH_4)_2SO_4$ 100	15,98±0,23	16,37±0,24	16,83±0,15	16,63±0,07	15,59±0,11
4	$(NH_4)_2SO_4$ 150	16,35±0,31	16,60±0,17	17,11±0,12	16,93±0,11	15,95±0,12
5	$(NH_4)_2SO_4$ 200	16,46±0,25	16,65±0,15	17,16±0,17	16,98±0,15	16,00±0,17

Dependence of pH value on regulations of nitrogen fertilizers and security of the soil with phosphorus is established. From the beginning of vegetation to blossoming it is observed pH value increase, i.e. reduction of degree of acidity of cellular juice of plants at all options, but in different degree. At plants of the doses of nitrogen fertilizers which are grown up in case of high fall of acidity of cellular juice is shown rather strongly, and at plants which grew up in case of smaller doses of pH of cellular juice changes considerably a little.

Their some lowering which was distinctly shown in a phase of maturing of seeds has begun with a phase of a fruit formation. At the same time a certain correlation between this process and other physiological-biochemical processes proceeding in plants was observed.

Note: The results of experimental data it is statistically processed by a differential method [6].

Similar results are received also concerning the oxidation-reduction potential (Eh).

The indicator of rH2 calculated on the basis of pH and Eh values demonstrates that in fabrics of an artichoke prickly grown up in conditions where applied higher doses of nitrogen fertilizers, and also in case of average and the soils which are strongly provided with phosphorus, recovery processes and vice versa at the plants which are grown up in case of weak doses nitric fertilizers prevail and also in case of weak and average security of the soil with phosphorus it is found shifts in a metabolism towards oxidizing processes.

As it is known the size of the oxidation-reduction potential (Eh) not only depends on the oxidizer relation to a reducer, but also on pH value of the environment.

With respect thereto it is possible to consider that Eh is a thermodynamic indicator of the physiological-biochemical processes proceeding in living cells and it is caused by both oxidizing, and recovery reactions.

It is possible therefore natural distinctions were observed as in content of albumens, free amino acids, nucleinic acids, carbohydrates, photosynthesizing pigments, fractional composition of water, intensity and net productivity of photosynthesis, biologically active agents in medicinal vegetable raw materials and in general biomass of a plant under the influence of nitrogen fertilizer of sulfate of ammonium in a dose of 150 kg/hectare in case of average security of the soil with phosphorus.

We managed to establish stability of the oxidation-reduction mode of cellular juice of an artichoke by change of doses of nitrogen fertilizers in case of cultivation of this plant and degree of security of the soil with phosphorus that is caused by a capability of plant cells as self-regulating systems and to maintenance of intracellular conditions, characteristic of this type.

Results of the researches conducted by us show that for preserving and increase of fertility of the old irrigated typical gray soils and receipt of big and high-quality crops of an artichoke prickly it is desirable to bring in the soil from nitrogen fertilizers of sulfate of ammonium in a dose 150 kg/hectare, phosphorus of 110 kg/hectare, and potassium of 75 kg/hectare in a combination of 20 t/hectare of manure.

In case of cultivation of an artichoke of development, prickly in initial phases (3-4 these leaves) it is reasonable to apply 30% of nitrogen fertilizers in the form of ammonium nitrate, and in subsequent periods of development in the form of ammonium sulfate.

It is necessary to emphasize that in case of cultivation of this plant studied by us the nitrogen ratio to sulphur (N:S) was equal 1,0:0,20 that promotes receipt of environmentally friendly biomass of an artichoke prickly.

In case of such approach of cultivation of an artichoke prickly increase in content of albumens, nucleinic acids, free amino acids, increases in content free and reduction of amount of the all-connected water and its components, increase in content of photosynthesizing pigments, strengthening of intensity and net productivity of photosynthesis is observed.

All this promoted acceleration of growth, development and productivity increase, and also strengthening of biosynthesis of biologically active agents (routines, quercetin and luteolin) in raw materials of an artichoke prickly that plays an important role during creation of effective medicines on the basis of its raw materials. Besides, creation of a plantation of an artichoke prickly will give the chance to suspend import to Uzbekistan of raw materials of this plant from abroad.

Conclusion: Our researches on studying of artichoke prickly and the developed technology of its cultivation is perspective and give the chance to provide domestic pharmaceutical industry of Uzbekistan with these vegetable raw materials of local production, for the purpose of use in production of various medicines.

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