

Modern breeding and cultivation of unpopular fruits and berries in Ukraine

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We analyzed the main tendencies of cultivation of fruit and berries, which are unpopular cultures in Ukraine for the development of national selection and industrial horticulture. Improvement of population diet could form a conjuncture food market fruit with high content of biologically active substances and raw materials for processing and food industries. We believed that the leading role in this can play industrial cultivation of valuable fruit and berry crops, the success of which is only possible for bringing together the efforts of selectionists, manufacturers, processors and processors. We presented that the area under industrial plantings of such unpopular fruit and berry crops could meet internal needs of population in fresh fruit, while the processing is insufficient. This is mainly due to lack of information about consumer value of fruit crops and insufficient availability of all the necessary components regards the cultivation of these crops (Blueberry, Cranberry, Actinidia etc.), as well as lack of sufficient number of certified varieties of planting material, even in the State Register, and also low level of national fruit-processing industry.

We concluded that considering the cultivation of crops with high content of biologically active substances to industrial scale and consumption of these fruits in sufficient quantity in fresh and processed form will definitely contribute to the improvement of the health of the population. This will also cause the development of the national market of fruit and berry products and increase the export of berries to the EU.

Keywords: Unpopular culture fruit and berry plants; Breeding; Growing technology; Biological value

Introduction

The brand of modern society is healthy food, a leading role in which plays the consumption of valuable food in terms of fruit and berry crops, most of which today are in the rank of the less widespread in the culture fruits and berries or niches. They in the structure of fruit plantations cover an area of less than 1%. Today it is more than 50 species and interspecific hybrids, significant diversity which increases due to introduction, acclimatization, selection and favorable climate change (Kasapidou et al., 2015; Leonel et al., 2016; Grynyk et al., 2018; (Sofronov, Firsova, 2018). According to the State Department of Agriculture of the United States, person uses, grows and consumes for food about 10,000 of plant species, of which fruit and berries account for over 800 species, although the world's resources they are about 5,500. However, according to experts, in connection with the constant increase in the population world consumption of fruits and berries annually grows by 3–4%, organic – by 8% (Klumenko, 2011; Kucharska et al., 2015; Grabovetska, Ezhov, 2015; Babaieva et al., 2016).

Over the past decade, Ukraine is rapidly losing a leading place its prominent place on the market for genetic resources. Thus, in the next 5 years, according to experts, three-quarters of the varieties presented will be of foreign origin. This situation is of considerable concern to industry professionals not only due to increased import dependence varietal, but also the real prospect of a final decline of national breeding activity (Kucharska et al., 2015; Babaieva et al., 2016).

As noted S. V. Klumenko (Klumenko, 2011), the need introduction to the culture of new, so-called «unconventional» plants is connected with the necessity of increasing the medical and dietary qualities of horticultural products, as many kinds of fruit plants recently introduced into the culture, contains a large number of biologically active substances (BAS). Of particular importance is not only the consumer but also the antioxidant activity of these fruits. As in Ukraine, in recent decades, due to the deterioration of the environmental situation, the tension of the emotional and stress state, unbalanced nutrition, there is a significant increase in the general morbidity of the population. Therefore, the search for ways to improve the health of a person, including, related to the improvement of nutrition, is an actual task of modern gardening in the framework of national security (Krivoruchko, 2016).

The issue of selection, implementation and technology of technological elements of growing less widespread fruit and berry cultures devoted to labors: S.V. Klymenko, V.M. Mezhenkij, O.M. Derevianko, O.A. Grabovetska, Z.A. Shestopal, I.P. Nadochiiy, O.M. Yareshchenko, H.I. Babaieva, V.S. Frantsishko, V. M. Batochenko, V. H. Chyrka, V. V. Krasovskyi, V. P. Kravchenko (Klumenko, 2011; Derevjanko, 2013; Kasiyanchuk et al., 2013; Grabovetska, Ezhov, 2015; Kucharska et al., 2015; Mezhenkij V.N., Mezhenka L.O., 2015; Babaieva et al., 2016; Rudnyk-Ivashchenko, Sukhomlyn, 2017; Skrypchenko, 2017; Sizaya et al., 2017; Grynyk et al., 2018; Yareshchenko, 2018), etc. However, the national literature does not enough the current state and trends growing of the less widespread plants, substantiation of their directions in the development of national industrial horticulture.

The purpose of the research – is analysis of the current state and the main growing tendencies of less widespread fruit and berry culture plants in Ukraine, substantiate the main directions for the development of national breeding and industrial horticulture as a raw material base for the production of functional products.

Methods

The material for research served as a collection of plantings Sea buckthorn, Snowball tree, Asimina, Rowan, Black chokeberry, Blackberry, Honeysuckle, Blueberry Laboratory of Berry Selection and Technology of Growing of the Institute of Horticulture of NAAS and its network. The practical basis for research were the morphological, comparative, hybrid method, selection method induced by chemical and physical mutagenesis, as well as theoretical methods of comparison, analysis and synthesis, a system approach to studying scientific and practical issue of selection and breeding less widespread fruit and berry cultures in modern horticulture, legislative and others normative acts data of the State Statistics Service of Ukraine and the United Nations Organization The Food and Agriculture (FAOSTAT ..., 2015; 2018).

Studying the source material of less widespread fruit and berry crops were conducted according to the methodology (Syedova, 1995), selecting research performed according to Program and methods of sorting fruit, berry and nut crops (Syedova, Ogoltceva, 1999). Determination of the biochemical composition of the fruits conducted in accordance with SSTU ISO 2173:2007; (2009) SSTU ISO 4954:2008 (2009); SSTU ISO 4373:2005 (2006); SSTU ISO 8069:2015 (2017); SSTU ISO 6557-2:2014 (2015).

The probability of the indices ($p < 0.05$) was assessed by Student test. The results of fruits biochemical composition were processed by means of Statistica 12.0.

Results and Discussion

Analyzing the horticulture industry in general, it should be noted that along with the culture Apple, Sour cherry, Strawberry, Raspberry, growing interest in the cultivation of niche fruit and berry crops, in particular, Blueberry, Actinidia, Black chokeberry, Quince, Chaenomeles, Asimina, Cornelian cherry, Snowball tree, Sea buckthorn, Black elderberry, Rowan, Hawthorn, Hazel, Turkish hazel etc. It is for these listed crops today there are niches in world markets agro-food products. According to national scientists and market analysts (Babaieva et al., 2016; Klumenko, 2011; Grabovetska, Ezhov, 2015; Kucharska et al., 2015), today it is possible will highlight some important factors of cultivation expediency less widespread fruit and berry crops (Figure 1). First, the high consumer value of the fruits of less widespread cultures reduces Ukrainian farmers to pay more attention to cultivation. These cultures have their own buyer and relatively stable price for a stable export market, which is easier to predict-since it is not so dependent from demand for other products (Babaieva et al., 2016).

According to the «Sectoral Program development of horticulture of Ukraine for the period up to 2025», approved by the President of the National Academy of Sciences of Ukraine rapid development of horticulture based on effective patterns of management of various forms of ownership. Therefore, further strategy growing of fruit crops in Ukraine should anticipate revision of the formation of the food market conjuncture, in terms of security population biologically valuable food products and raw material for processing and the food industry, and not just gross production separate export-attractive types of horticultural products. To address this problem, particular attention should be paid to the cultivation of such fruit crops, which provide obtaining, first of all, biologically valuable raw materials, as a source of products functional purpose. Therefore, a gradual introduction into the culture of new and "forgotten" species in need development of a conceptual scheme from the genotype of the variety, places and technology of it growing to a qualitative composition the final product including its implementation on the national and foreign markets.

With raw materials of fruit and berry produced the following products concentrated juices, frozen fruits, frayed fruit with sugar, nectars, purees, smoothies, compote, morses, fruit-berry preserves, fruit toppings and fillings, ciders, flavors, sublimated fruits, powders, pectin, jams, marmalade, fruit mixes, fruit marinades, jelly candies, as important products in the diet of different groups of people, including, for children and for dietary nutrition (Grynyk et al., 2018).

A separate group of imported goods composing pectin, dried fruits and berries, fruit distillates, fruit and berry wines (Kasapidou et al., 2015). The state statistics do not allocate separate processing of fruits. According to official data of State Statistics (Plant growing ..., 2018) noted a general trend to reduce the number of processing enterprises in Ukraine and those employed in this area of work. In 2014 there were already 335 enterprises engaged in the processing and preservation of fruits and vegetables.

Branches development program horticulture for the period by 2025, provides for stabilization and further increase production of fruits and berries; saturation internal the food market of competitive products and their wide export; increase in production normatively safe products by way of transition from industry-chemical methods of farming to biological; increase in production normatively safe products by way of transition from industrial and chemical methods of farming to biological.

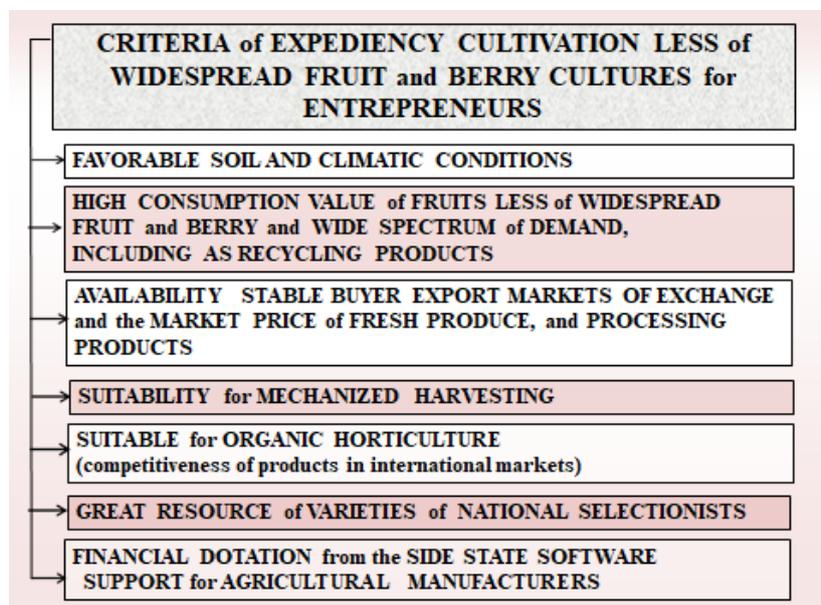


Figure 1. Criteria of expediency gerads cultivation of unpopular fruit and berry crops.

It is worth noting that in Ukraine, as in most countries of the world no official statistics concerning the areas and volumes of production less widespread fruit and berry crops. According to the State Statistics Service of Ukraine ((Plant growing ..., 2018), our calculations and estimates by experts from the Institute of Horticulture of National Academy of Agrarian Science (Grabovetska, Ezhov, 2015; Mezhenkij, Mezhenka, 2015; Rudnyk-Ivashchenko, Sukhomlyn, 2017; Grynyk et al., 2018; Yareschenko, 2018) and others (Klumenko, 2011; Derevjanko, 2013; Kasiyanchuk et al., 2013; Babaieva et al., 2016; Skrypchenko, 2017; The annual branch ..., 2019), United Nations Organization on Food and Agriculture (FAOSTAT ..., 2015; 2018), areas under the basic less widespread fruit and berry crops, in the structure of farmsteads and farms are as follows (Table 1).

Table 1. Areas under the main less widespread fruit and berry crops in farms of different forms of ownership, as of 2018

Crops	Area, ha	Yield capacity		Duration of fruiting, years	Gross fees, 2018, t	Export/Import, t
		1 plant, kg	t ha ⁻¹			
Blueberry	2800.0	1.5-2.0	8-10	40	5,700	3,500/120
Cranberry	252.0	0.8	15-20	60-80	580	350/-
Wild rose	150.5	1.0-4.5	3.0	15-25	—**	—
Honeysuckle	120.0	2.5	5-10	20-25	400	-/8
Sea buckthorn	60.5	12-15	10-15	20-30	450	70/-
Cornelian cherry	46.5	40-80	38-40	>50	250	20/-
dogwood						
Black chokeberry	40.0	4.5-10.0	15.0	40	200	40/-
Diaspyros	22.5	180-250	80-100	30-40	1,850	-/23,000
Snowball tree	22.0	9-12	15-18	20-30	160	120/-
Quince	21.0	30-150	30	>50	0,140	-/-
Black elderberry	20.0	30	15.0	20-25	30	5/-
Actinidia and Kiwi	16.5	10-20	5.5	40	**	30/15,000
Pistacia	10.5	16-26	6-11	>100	**	-/3.0
Bird cherry	10.2	20-40	2-4	>50	20	0.8/-
Mulberry	3.4	20-30	6.5-8	40	20	5/-
Chaenomeles	0.8	3.0-5.0	15-25	15-18	16	-/-
Goji	0.5	0.8-3.0	3.1	20	0.8	-/2.5
Serviceberry	—*	1.8-3.2	2.2	>50	*	-/-
Rowan	—*	14-20	10.0	30-40	*	-/-

Note. — Industrial plantations not found;

** Industrial plantations did not enter the period of commodity fruiting.

The formation of the domestic market rare plants in culture only begins to acquire a systemic form. So, the deficit of the Ukrainian fruit production confirmed stable high seasonal price, lack of assortment in shopping malls (except for big cities) and lack of products even for a few lines fast freezing. One of the most expensive berries in Ukrainian markets through the low offer is Blueberry (in 2018 the price for it did not fall below 70 UAH/kg). In recent years, from niche cultures fastest growing the area under this crop, the industrial production of which already exceeds Raspberry.

Trends to raise the price of berries products, despite the economic «fever», are traced in the world markets. If berries are perishable (in particular Strawberry, Raspberry) may become outsiders of the market through overproduction, then the most promising, in terms of demand and given the the convenience of growing and storing, becoming Blueberry. Areas under the plantings this culture practically in Ukraine doubled since 2016 and as of December 2018 the total area under its plantations exceeded 2,100 hectares and the gross tax is 3,700 tons.

Leading European countries producing berries Blueberry are Spain, Germany, Poland and the Netherlands (FAOSTAT ..., 2015; 2018). To these countries today accounted for more than 70% European production. For Ukraine to create industrial and manor Blueberry also are quite promising. After all completely satisfied demand is only blighty Blueberry, according to experts estimates, could be no less 6,000–8,000 ha. As follows for the internal needs Ukraine berries need to have more 6,000 ha plantations.

In recent years a lot of attention is paid valuable in food promising very early berries – Honeysuckle, which in the 2018 was recognition, a food product in the European Union. Also important role in promoting this berry actively reflect representatives berry business in Poland, where large areas are reserved for Honeysuckle (more 3,000 ha), and its production is growing rapidly. In Ukraine under its busy only 120 ha, and half of commercial production accounts for only three farms (Kyiv, Kharkiv regions). However, some experts – S. V. Klumenko, O. M. Yareschenko (Klumenko, 2011; Kucharska et al., 2015; Yareschenko, 2018), consider it an underestimated culture, despite the presence in the fruit whole number of useful microelements and that the berry has become popular it is necessary to develop a certain culture of consumption, and that this segment began to evolve time is needed, maybe not even one decade. Such an example in Ukraine took place with Blueberry.

Increased demand for world market is observed today and the culture of Sea buckthorns. This is one of the newest fruit plants for industrial horticulture. Her fruits are very useful, they are used as fresh, and for the manufacture of natural medicines (tinctures, sea buckthorn oil, cosmetic ingredients, etc), and Sea buckthorn tea is popular since the days of Genghis Khan. Since the Russian market closed, the cultivation of Sea buckthorn becomes a new trend on the fruit and berry market, because of what in Ukraine begin industrial plantations appear this culture area 2-20 ha (Kyiv, Cherkasy, Chernihiv, Kherson, Zhytomyr and others region). At the Sea buckthorn today there is a stable demand among exporters. In particular, on frozen fruit you can get a high export price, covering all expenses for their cultivation. In addition, the growing demands among consumers on products from Sea buckthorn (lemonade, juices, sauces, wines) opens up opportunities for establishing cooperation of food retail and catering establishments. Sea buckthorn was ignored large Ukrainian producers, while the world market over the past five years has grown to 40% (Grynyk et al., 2018).

In the context of global climate change, new high performance and ecology-adaptive, suitable for technical processing are varieties of breeding the Institute of Horticulture of National Academy of Agrarian Science: "Osoblyva", "Adaptyvna", "Oliana" (Figure 2), which will be included in the State Register during 2019.

The fruits of these varieties, having the optimal content fatty acids and prokarotin are suitable for production functional beverages with high content of biologically active substances (fruit juices, wines of fruit and berries dry, dessert), for which patents for the invention are being prepared.

Growing demand for Buckthorn the country can cover only the opening of new processing plants. According to experts, a significant surge of interest is noticeable in countries such as: Japan, South Korea and Singapore. Today, the market for this culture estimated at \$ 1 billion (FAOSTAT ..., 2015; 2018). Market of processing products Sea buckthorn is estimated at \$ 17 billion. Together with the the notable increasing demand the offer for this culture is still low.



Figure 2. Varieties of Sea buckthorn "Oliana" (A), "Adaptyvna" (B) (authors: V.S. Frantsishko, T.Z. Moskalets, V.V. Moskalets, I.V. Grynyk).

Blackberry common has acquired commercial value and proved its exceptional profitability. Thanks to the new varieties and innovative approaches to growing technology, this culture is economically promising. No other berry culture not capable of already on 2–3 years after planting bring so generous yield per unit area as Blackberries. Some of its varieties are given from one bush over 10–12 kg of berries. However, despite the high demand for Blackberry in Ukraine there is practically no industrial plantings of this culture. First of all it is connected with labor-intensive ones technological features of its cultivation: the presence of wallpapers, shelters of shoots for the winter with the previous take-off shoots to the level of the ground and again manual attaching them to the wallpaper.

According to specialists of the Institute of Horticulture of National Academy of Agrarian Science (Yareshchenko, 2018), in Ukraine under this culture in 2017 about 100 hectares were occupied. At the present time, interest in growing this berry are manifest as gardeners, and large commercial farms, who at her expense want to diversify production. Theoretically, a plantation of Blackberry is paying for the third year already. And this, given the high costs on the plantation tab with the formation wallpaper and selling prices at the level 30–45 UAH/kg for fresh berries and for processing. Meanwhile, world leaders by the volume of growing Blackberry are Europe and North America.

A relatively new and very promising among the less widespread crops, which has an industrial potential is a Cornelian cherry dogwood. Among the main benefits this culture over others are: lack of periodicity of fruiting; high yield; duration of the productive period; high biological value of the fruits; simplicity to growing and significant pruning the absence of pathogens and pests (Kucharska et al., 2015; Mezhenkij, Mezhenka, 2015). Main reason, in which the dogwood belongs to the less widespread crops – insufficient study of the features of reproduction and cultivating culture in different climatic zones, low fruit processing (Kucharska et al., 2015; The annual branch ..., 2019).

In Ukraine the planting of Cornelian cherry exist in almost all regions (the largest in Zaporizhzhia, Cherkasy, Kyiv, Rivne, Zakarpattia regions). Very popular this crop in many countries of the world among which: China, Japan, Georgia, Greece, Poland, Bulgaria, Serbia, Slovakia, Czech Republic (FAOSTAT, 2015; 2018).

Selection work, collection of various forms Cornelian cherry are held in M. M. Gryshko National botanical garden NAS of Ukraine (Kucharska et al., 2015). Especially great contribution in the creation of various varieties of Cornelian cherry S. V. Klumenko, due to the selection of which, this culture acquires more and more spread in the territory of our country. In particular, it is the appearance of the first industrial Cornelian cherry gardens among which is one of the largest in Europe, located in the Zaporizhzhia region, the total area of about 16 hectares. In the Vynohradiv district in Zakarpattia, in the tract Botar an island with an area of about 30 hectares has been preserved planted healing miracle tree. It is believed to be one of the largest natural plantation dogwood not only in Ukraine but also in Europe.

No less important by food and consumer value there is a culture of Quince Japanese which now cultivated in more than 40 countries globe in temperate zones warm and subtropical climate. However, its plantation in most countries is negligible. According to the database FAOSTAT (FAOSTAT ..., 2015; 2018) as of 2009 largest area under worldwide were employed in Turkey – 9,800 ha, Uzbekistan – 7,000, Argentina – 3,200, Azerbaijan – 3,100, Serbia – 2,200, Algeria – 1,800, Spain – 1,400, Russia – 1,000 hectares. Quince occupies in other countries an area from 100 to 600 ha. In Ukraine as of 2010 it was grown on an area of 900 hectares in farms of different forms of ownership (Plant growing ..., 2018; The annual branch ..., 2019), but as of 2017 – its area has decreased tens of times. Industrial plantations Quince focusing in Ukraine in the southern regions and make up not more than 1–2% of the area of all fruit plantations. However, no garden plot can not do without Quince, it likes in Crimea and the southern regions: Odesa, Mykolaiv, Kherson, Zaporizhzhia (Klumenko, 2011; Mezhenkij, Mezhenka, 2015).

Quince is also distributed in Bukovina and Zakarpattia. Plants of Quince varieties national selections are withstand winter temperature reduction -23... -25°C. Conditions of the Forest-Steppe and Polissia of Ukraine fully provide Quince fruit ripening. A

crop from a tree in the productive period is 50–100 kg, or 25–30 t/ha. The most productive period – from plants from 8–12 to 15–40 years (Klumenko, 2011; Kucharska et al., 2015). In 2019 is scheduled to be create the first in Ukraine variety plantation of Quince Japanese which will supply organic raw materials for recycling.

Snowball tree is a culture which fruits are suitable for processing, food, pharmaceutical and others (Sofronov, Firsova, 2018). But still for today stays in the ranks of the rare in industrial and decorative horticulture. The main factors which limit its spread are: strong bitterness of fruits and technological difficulties while growing plant material. Some authors (Kasiyanchuk et al., 2013; Sizaya et al., 2017) note the lack of high-yielding varieties Snowball tree and bitter taste of the fruits of wild plants, which holds back the spread of culture both in industrial production and in the private sector. However, national breeders for a long time work is carried out to create new varieties of this crop, resulting in national achievements are 9 varieties of universal purpose: 5 on to Mliivska SRS Institute of Horticulture of National Academy of Agrarian Science ("Ukrainochka", "Rubinova", "Koralova", "Bahriana", "Velykoplidna"), 2 – selection of M. M. Gryshko National Botanical Garden of National Academy of Science ("Berehynia", "Nasoloda") (State register ..., 2019), 2 – Institute of Horticulture of National Academy of Agrarian Science of Ukraine ("Ania" and "Uliana"). These are high-yielding varieties (14–20 t/ha), with high qualitative indicators fruits and low bitterness especially the last two.

In recent years it has begun work to create plantations common mushrooms. In particular, in the Deliatyn forestry plant (Ivano-Frankivsk region) (Krivoruchko, 2016; Sizaya et al., 2017), the gross collection in it reaches 100 tons of fruits *Viburnum*/year Svirzh forestry (Lviv region, area 0.6 ha), Brody forestry (0.5 ha) and others.

Last 30 years due attention not paid to such a valuable fruit, decorative and technical culture as Mulberry. Despite the excellent taste it fruits and its preventive and therapeutic action the latest newly created varieties of Mulberry was registered only in 2009 (Donetsk Botanical Garden of the National Academy of Science). In connection with military actions to date, none of its varieties not supported. Given the high demand from private gardeners on the Mulberry seedlings at the Institute of Silk Studies of the National Academy of Science from 2011 started the selection on yielding fruit varieties (Babaieva et al., 2016; Rudnyk-Ivashchenko, Sukhomlyn, 2017) study the biological characteristics, introduction, reproduction and improvement of cultivation technologies mulberry, creation collections of various kinds involved in M. M. Gryshko NBG NAS, and starting from 2015 at the Institute of Horticulture of NAAS, where technologies are being developed vegetative and seminal proliferation of perspective forms with a high level of decorative.

Limiting factor of distribution Mulberry according to the Department agriculture is American white butterfly (*Hyphantria cunea* Drury.) – quarantine pest, which damages over 250 species of fruit, ornamental, forest and other crops. Especially it is heavily damaging Mulberry, Maple, Nut, Apple, Pear, Plum, Cherry, Poplar, etc. At the same time, in the conditions of our country the first generation of a pest almost always develops on the Mulberry, and the second generation – on Maple, Nut, Apple and other fruit trees.

Today, in the world is growing in interest to the consumption of the fruits of Actinidia, as a consumer-valuable dietary dessert, through which more and more large areas are laid under the production plantations of this crop (Skrypchenko, 2017). Fruits in Actinidia are smaller, than in Kiwi but through smooth and its can use a thin peel in food without purification. They contain about 400 mg% vitamin C, then as Lemons and Oranges (contain about it 100 mg). The fruits are consumed fresh and widely used for processing. Of the two kinds, similar among themselves, through more high yield deserve attention Hardy kiwifruit (*Actinidia chinensis*). Currently these industrial plantings concentrated in the United States, Chile, Japan and New Zealand. In recent years, it has been successfully completed the introduction on the Belgian market as well as in the market of Germany, Austria, Switzerland and France (FAOSTAT ..., 2015; 2018).

The main problem of potential manufacturers remain question of selection of varieties, which are best suited for the industrial cultivation of this crop. Currently, the world is known several dozen varieties Actinidia arguta. There are also hybrids with other species (e.g., *A. melanandra*, *A. purpurea* i *A. polygama*) (Skrypchenko, 2017). In Europe, industrial plantations of Hardy kiwifruit established in Spain, Italy, Belgium, France, Poland, and others. As of October 2018 the largest commodity fruitive an industrial plantation in Europe is a planting of Actinidia, or Kiwifruit, an area of 14 hectares in Biliavka district Odessa region, as well as somewhat smaller area in Cherkasy region.

Important technological an element of cultivation of Actinidia is that this culture is two-domed (requires placement of male and female plants in a ratio 1:4–8, depending on the variety although there are self-fertilizing varieties) (Skrypchenko, 2017).

Growth Actinidia in Ukraine is a promising financial area. This is due to the following: low competition in the domestic market, high frost resistance of plants, their longevity (about 80–100 years), resistance to many pathogens and pests and high keeping quality of fruits (can be stored up to 2 months at a temperature from 0°C to + 2°C).

Among all the berry crops, which grow in conditions of the Ukrainian climate, one of the most underestimated in terms of industrial cultivation, there is a Cranberry. Despite, that Ukraine is entering in the top ten world leaders in its production, in 2016 collected 338 tons total valuable on the international berry market, which is about a thousand times smaller, than in the USA and five hundred times less than in Canada (FAOSTAT ..., 2015; 2018). Even so small in area of the countries, as Belarus and Latvia overtook Ukraine by Cranberry, though in 2013 this berry has been gathered more, than doubled – 800 tons (The annual branch ..., 2019).

Such instability harvest Cranberry is caused by that the bulk of berries in Ukraine collected in natural conditions, and in countries-leaders it is grown on agricultural plantations. But, given the fact that the area of the forest decrease, respectively, reduced fees wild Cranberry, while on the corresponding soils it can be cultivated using high-yielding varieties, as practiced in Belarus and Latvia. Over the past 5 years, in Ukraine took place some decline in the area under a Cranberry (200 ha), compared with 2011 (300 ha), but in recent years there is increasing industrial areas under the culture. Its yield is from 6 to 11 t ha⁻¹, the highest – 30 t ha⁻¹, and the record yield of varieties in culture – 4.5 kg m⁻², or 45 t ha⁻¹. Plantations of Cranberry are fruiting 60...100 and more years.

Promising for industrial culture there is a Cranberry giant (*Oxycoccus* × *gigas* Hagerup.) – little-known species, like a Cranberry fenny. Among the Cranberries stands out not only the largest mass of berries, but also the most resistant to drought and can grow outside of the marshes.

Technical problem cultivation Cranberry is in the absence of information about the possibilities of growing it and planting materials for reproduction in Ukraine, as well as the risks of dependence on monoculture.

Ukraine can double gross production fruit and berry products, including by spreading areas under national varieties valuable consumer relationship high-performance niche crops: Sea buckthorn, Serviceberry, Asimina, Honeysuckle rowan, Actinidia, Blueberry, Quince, Snowball tree etc. Wide introduction into production is actively conducted in most economically and socially developed countries of Europe, and also USA, Canada, Australia, Japan. Of particular importance are acquired new and "forgotten"

cultures, consumption of which fruits, even in small quantities, provides the need of the human body in the necessary substances preventing the emergence of development alimentary-dependent states and diseases, contributing to the elimination of vitamin deficiencies antioxidants, micro- and macroelements.

By the content of biologically active substances, as a result of the conducted selections and selections, highlighted the following valuable and perspective forms Black chokeberry, Rowan and Sea buckthorn (table 2) for food production (juices, marmalade, jam, jelly, fruit powders, dried fruits, dyes, fruit teas).

Fruits of the above varieties and forms of less widespread fruit crops are valuable raw material for industrial processing. We recommend these forms and varieties for the production of products therapeutic and prophylactic value including, for children and for dietary nutrition.

Table 2. Biochemical composition fruits selected forms of less widespread fruit crops ($M \pm m$, $n=4$)

Crops	The content of the fruit, % on the cheese mass						
	solids	total sugars	pectic substances	vitamin C	phenolic substances	carotenoids	p-active substances, mg%
	mg/100 g						
Form 2-24-72 Black chokeberry	17.5 ± 0.3	11.4 ± 0.3	1.98 ± 0.2	76 ± 1.5	782 ± 9.0	–	2830 ± 13
Form 83-87-21 Rowan	16.8 ± 0.8	5.8 ± 0.5	1.54 ± 0.3	98 ± 2.7	916 ± 5.2	–	463 ± 5.2
Form 4-13-10 Rowan	19.2 ± 0.6	7.6 ± 0.9	1.40 ± 0.3	110 ± 3.4	982 ± 6.0	–	910 ± 4.1
Variety "Osoblyva" Sea buckthorn	24.7 ± 0.4	6.3 ± 0.5	0.62 ± 0.1	23 ± 2.5	381 ± 3.4	2.1 ± 0.50	–
Form 1-15-3 Sea buckthorn	25.6 ± 0.8	3.5 ± 0.4	0.78 ± 0.2	25 ± 2.9	309 ± 2.5	3.8 ± 0.72	–

Notes: selection of fruits were conducted in the phase of technical maturation. – determination not performed.

Provided effective marketing domestic fruit products will have significant export potential. But to saturate the domestic market and export development needed significant investments for distribution innovative technologies of production of fruit of niche cultures, strengthening of material and technical base its storage and product completion. In view of this, remains relevant today state support of the industry, namely the need to continue funding according to the budget program 2801350 "State support for hop development the laying of young gardens vineyards and berries and overseeing them". In the near future urgent need is in introducing preferential lending to create gardens formation of production and market infrastructure with annual rates not exceeding 5–7% and repayment of the loan after the introduction of plantings in commodity fruiting.

However, today, clear reasons are highlighted impeding wide implementation less widespread fruit and berry crops (Figure 3).

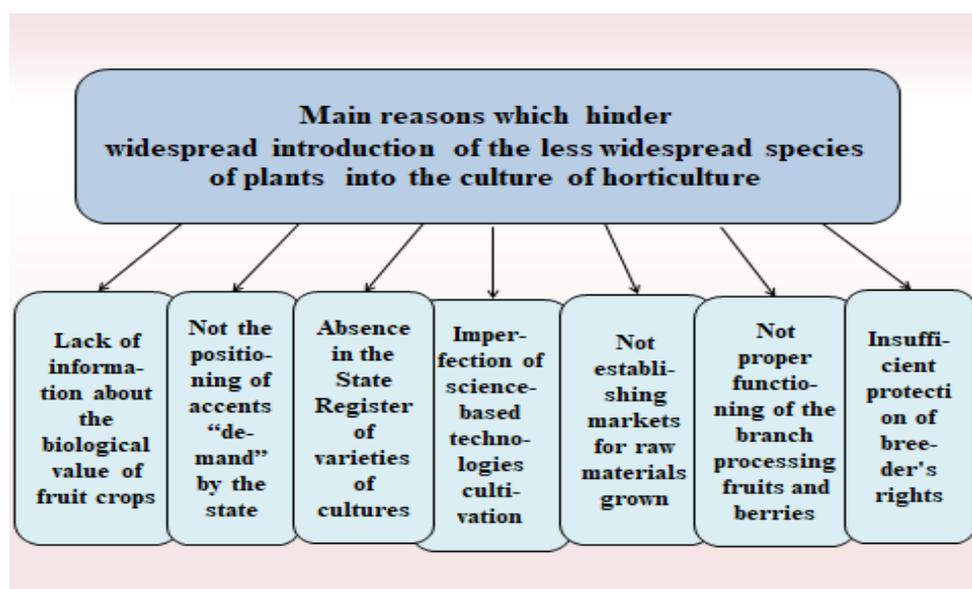


Figure 3. The main reason, impeding wide implementation less widespread fruit and berry crops on an industrial basis

This is primarily lack of proper culture of nutrition, lack of information about biological value of fruits, etc. Because of that, the pace of growth active introduction and cultivation fruit-rich less widespread crops gets a lot of popularity in modern horticulture only in

the last 4–5 years and, as practice shows, more often preconditions for this are cyclicity of overproduction of traditional fruit and berry crops (Apples, Strawberry, Raspberry, etc.) and their import from neighboring countries. Significant factors are also low level of national fruit-processing industry, without which prospective development of horticulture impossible; lack of varietal planting material; not debugging sales markets grown raw material; imperfections scientifically sound growing technologies; not the positioning of accents "demand" by the state.

However, the subjects of management, engaged horticulture viticulture, etc. continues to provide financial support for issues: 1) carrying out of work on laying of plantations, care for them before entering fruiting and the acquisition of the necessary materials; 2) the construction of refrigerators with regulated gas environment capacity from 500 tons for the storage of fruits and the acquisition of the lines of their commodity processing; 3) construction nurseries farms laboratory complexes for the production of virus-free planting material and fast freezing chambers fruits and berries by producers of products; 4) acquisition of machinery and equipment (including import production, which is not produced in Ukraine) for conducting technological operations in horticulture and new equipment for sublimation drying of fruit; modernization of refrigeration and gas regimes storage in refurbished refrigerators capacity from 500 tons.

As of December 2018, under the state program, it was intended to provide financial subsidies to producers for landing as traditional (Apple and Pear), both promising and on the Ukrainian, and in the world market of niche crops (Honeysuckle, Sea buckthorn, Snowball tree, Black chokeberry, Actinidia etc.) in the amount of 391 million UAH (Plant growing ..., 2018). In 2019 400 million UAH were allocated of the budget for the development of horticulture and viticulture (compensation gain 87 growers and gardeners) (The annual branch ..., 2019).

Thanks to the actual state support, in terms of compensation for the cost of gardening material, Ukrainian gardeners have created almost 4,000 hectares of young plantings, which are three times higher than that recorded earlier. It is interesting that the uncontested primacy among the cultures received hazelnuts and walnuts which account for half of the newly created areas.

Certification of planting material regarding commodity and varietal qualities gives grounds for receiving state compensation. A state compensation program is being developed for the construction of refrigeration warehouses for cooling and storing berries. Actual total number of branch enterprises, engaged in production fruits and berries are on a level 1,500 (one and a half times more for data on state statistics), after all a significant amount industrial manufacturers officially does not register its activities.

As for nurseries fruit and berry crops, then all of them in Ukraine are close 200, however, more than half of them are not certified. Also, according to research results of the Association "Ukrsadprom", about 110 enterprises are engaged in processing and preservation of fruit and berry products, and the total number of enterprises, related to horticulture industry, exceeds 1,800. Number of registrations nurseries of fruit and berry crops in Ukraine by results 2018 increased to almost 90 after a tangible decrease to 50 in 2017. Square under industrial gardens national varieties of rare crops will grow, because of the demand of domestic consumers and commodity producers, who now often spend significant resources for the import of gardening materials fruits and raw materials consumer-valuable fruit and berry crops instead of, to invest in their own production, supporting the national producer.

In the time of independence, to "State Register of Plant Varieties Suitable for Dissemination in Ukraine" it was carrying different assortment of crops, in particular, Actinidia, Quince, Hawthorn, Pomegranate, Blackberry, Honeysuckle, Fig tree, Kiwi, Sea buckthorn, Tree jujube, Hazelnut, Chaenomeles, Diospyros, Mulberry etc. Despite some successes, Ukraine still yields to neighboring countries, such as Russia, Latvia or Poland. As of December 2018 in "State Register of Plant Varieties Suitable for Dissemination in Ukraine" were carrying 467 varieties and hybrids of fruit crops, 68 of which – less widespread. But, as May 2019 number of varieties of such species as: *Cydonia oblonga* Mill., *Chaenomeles japonica* (Thunb.) Lindl., *Hippophae rhamnoides* L., *Lonicera caerulea* L. decreased at times, but the number of varieties *Diospyros* L., *Amygdalus* Mill., *Crataegus azarolus* L., *Asimina triloba* L., *Ziziphus jujuba* Mill., *Morus* L. etc. decreased to zero (Table 3).

Table 3. Number of grades fruit and berry crops in "State Register ..." in 2000-2019 (State register ..., 2019)

Crops	Total varieties in the State Register		
	2000-2013	2014	2019
Cornelian cherry dogwood	15	16	16
Actinidia	12	14	20
Quince	11	12	6
Blueberry	–	11	10
Chaenomeles japanese	8	4	4
Honeysuckle	6	5	3
Sea buckthorn	5	1	2
Almond	5	–	–
Asimina	3	–	–
Hawthorn	3	–	–
Tree jujube	2	3	–
Snowball tree	2	3	7
Common persimmon	2	–	–
Kiwi	2	–	–
Mulberry	2	–	–
Pomegranate	1	–	–
Fig tree	1	–	–
Schizandra chinese	1	1	1
Blackthorn	1	–	–
Blackberry	–	2	6
Oriental persimmon	–	8	–

The reasons for this are the costs for their maintenance in the register and variable market demand of consumers from nurser and processing of produce. Although, to a greater extent, the disappearance of the less widespread crops such as: Black chokeberry,

Rowan, Diospyros, Mulberry from the pages of the state register due to the collapse, former specialized farms nursery, breeding, harvesting and processing. Only at the expense of selection work in the past and the survival of small private business, makes it possible to include in the export of this raw material.

As can be seen from Table 3, industrial cultivation and holding nurseries work possible for such crops as Actinidia, Cornelian cherry dogwood, Snowball tree, Blueberry, Chaenomeles, Honeysuckle, Blackberry. Unfortunately, for such valuable species as Black chokeberry, Asimina, Tree jujube, Diospyros, Cranberry, Goji, Rowan, Service tree, Hawthorn, Hazelnut, Mulberry, Serviceberry – varieties or hybrid forms are absent in the State Register. And this, in turn, is an obstacle to official nurseries, state compensation payments and royalty, protection and preservation copyright breeder, the formation of internal and external economic activity, attraction of agrarian enterprises to participate in export operations, promotion of domestic products agricultural commodity producers to foreign markets.

At the Institute of Horticulture of NAAS and its network in order to preserve and increase diversity of genetic resources fruit and berry crops, productive work is done over the creating collections of a new species and varieties, hybrids and population varieties of these crops: Blackberry, Blueberry, Honeysuckle, Snowball tree, Mulberry, Sea buckthorn, Service tree etc. Active implementation to markets of consumer-valuable "super-fruits" promotes rapid development in Europe new trends in healthy eating, confectionery production, processing industry and cosmetology. Volumes of functional foods in the international market every year increase by 15–20%, which is due to widespread implementation improvement of cultivation technologies and the selection of less widespread crops. National growing experience less widespread fruit and berry crops, as well as the introduction of advanced elements of technology their cultivation gives all the grounds effective development of this industry modern horticulture of Ukraine.

Conclusion

Search for ways to improve nutrition of the population is to form the conjuncture of the food market for biologically valuable food products and raw materials for processing and food industries the leading role in what plays popularization and industrial cultivation valuable fruit and berry crops. This can be achieved only for joining forces breeders, producers, technologists and processors.

Today, in Ukraine, area under industrial plantings of the less widespread fruit and berry crops to meet internal needs population in fresh fruit and the processing is insufficient. This is due to problems as a theoretical direction – lack of information about consumer value fruit crops, and technological – availability of all necessary components the cultivation of these crops (Blueberry, Cranberry, Actinidia etc.), as well as lack of sufficient number of certified varieties of planting material, including, varieties in the State Register, low level of national fruit-processing industry.

Supplying to industrial scale cultivation of less widespread fruit and berry crops with high content of biologically active substances and consumption of these fruits in sufficient quantity in fresh and processed form, will contribute to the improvement of the health of the population and the development of the national market of fruit and berry products and increase the export of berries to the EU, entering new markets.

The development of the market for fresh fruits and berries contributes to public funding (insurance, grants, subsidies, partial compensation, grants on the bookmark of fruit plantations; preferential taxation and lending), provided by sectoral budget the support program.

In Ukraine with fruit and berry raw materials produced the following products concentrated juices, frozen fruits, frayed fruit with sugar, nectars, purees, smoothies, compote, morses, fruit-berry preserves, fruit toppings and fillings, ciders, flavors, sublimated fruits, powders, pectin, jams, marmalade, fruit mixes, fruit marinades, jelly candies, as important products in the diet of different groups of people, including, for children and for dietary nutrition.

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