

Biological potential of hybrids of a cucumber of foreign selection

Sevidov V.

V.V. Dokuchaiev Kharkiv national agrarian univer-sity, Dokuchaievske-2, Kharkiv region, Kharkiv oblast, 62483, Ukraine; e-mail: sevidov.vp@gmail.com

The purpose. To study, assess and select assortment of hybrids of a cucumber of foreign selection according to biological potential in conditions of growing in film glasshouses of Left-bank Forest-steppe.

Methods. Laboratory-analytical, experimentally-field, statistical. **Results.** Indexes of variability of levels of solid basis and basic chemical elements in fruits on an instance probed assortment of hybrids F1 of a cucumber of foreign selection are calculated and analyzed. **Conclusions.** In film glasshouses of Left-bank Forest-steppe it is expedient to cultivate modern hybrids F1 of a cucumber of foreign selection Lenara F1 and Ecole F1. These hybrids among probed ensured the greatest content of sugar (2,49% in fruits of hybrid Lenar F1 and 2,48% in fruits of hybrid F1 Ecole), of ascorbic acid — 8,97 and 9,38 mg/100 g accordingly.

Key words: cucumbers, hybrids, productivity, quality, biometrical indexes, chemical composition, film glasshouses.

The widespread distribution of cucumber in Ukraine is determined by its nutritional and fodder value, high dietary and therapeutic properties, significant use in the processing industry and cosmetics and the external attractiveness of plants. Cucumbers are one of the main vegetable crops, occupying about 12% of the crops area in Ukraine. Immature fruits are used in food, when their outer shells and seeds are not yet coarsen. They are consumed in fresh, salty, marinated form [8]. Fruits of cucumber contain 4-6% of dry matter, of which: 3-5% of mineral salts, 1-1,3% of sugar, extractives - 0,4-1,8% without nitrogenous and 0,35-1,1% of nitrogenous . Total cucumber fruit has up to fifteen biologically active substances and mineral salts. It determines their nutritional value for nutrition and maintenance of normal metabolism.

Analysis of recent research and publications. Since cucumber fruits contain 94-96% of water, their energy value is low and is only 63 kJ / 100 g. In addition to water, the composition of cucumber fruits consists of sugar - 1.6-2.5%, nitrogenous substances - 0.8-1, 0%, food fibers - 0,5-0,7%, fats - 0,1%, pectin substances - 0,24%, hemicellulose - 0,1% and fiber, lignin and starch - 0,68%. Depending on The variety (hybrid) and conditions of cultivation in cucumbers contain 0.5-0.7% mineral salts. [7] The main of which are salts: potassium - 140-186 mg, phosphorus - 20-43 mg, calcium - 15-20 mg, sodium - 7,0-8,5 mg, magnesium - 8,0-14,0 and iron 0.5-0.9 mg / 100 g [1]. Of the trace elements in the fruit of the cucumber contains (mg / kg of dry matter): aluminum - 80, nickel - 60, zinc - 50, manganese - 50, copper - 30, lead - 30, iodine - 0,9, as well as silver, fluorine, chrome, vanadium, soap [9].

One of the most valuable components of cucumber is the vitamins that are needed to maintain normal metabolism. In the fruit of the cucumber contains a number of vitamins (mg / 100 g of crude matter): ascorbic acid (C) - 7,5-20,0, thiamine (B1) - 0,02-0,04, riboflavin (B2) - 0,03 -0.04 pantothenic acid (B3) - 0.24, pyridoxine (B6) - 0.035-0.04. Carotene (provitamin A) - 0,06-0,28, biotin (P) - 0,02, nicotinic (PP) - 0,2 and folic acid (B9) [11,12]. Vitamin C and carotene are in the green petiole of fruits and although their content is low, it is the most active oxidase of ascorbic acid, in cucumber juice - peroxidase. Fruits of cucumber also contain active dehydrazides - amidohydraz, tsitricodegidra, succindehydraz, phosphoric glucose, glutathione reductase and pectinosterase, a proteolytic enzyme that hydrolyzes pectin and casein with the release of tryptophan, dissolves gelatin and breaks down milk. The peptonizing enzymes contribute to a better

assimilation of proteins and vitamin B2. In the cucumber, an enzyme close to insulin was found, indicating its value as a dietary product [6].

A characteristic aroma gives the fruits organic acids and essential oils, and refreshing taste - the ratio of sugars, organic acids, nitrogen compounds and essential oils [5].

The broth of old fruit or seeds was used for jaundice, liver diseases. Fruits of cucumber have diuretic, choleric and laxative properties, stimulate appetite, increase the secretion of gastric juice (especially pickled and marinated), promote the assimilation of fats and proteins [10]. Thus, providing a person with fresh cucumber products that is able to normalize and heal the body is one of the urgent scientific tasks based on the development of effective cropping techniques and new hybrids.

The purpose of the research is the assessment and selection of the biological potential of hybrids of cucumber of foreign selection for growing in film greenhouses of the left-bank forest-steppe of Ukraine.

Materials and methods of research. The research was carried out during 2015-2017 in the field crop rotation of the department of fruit and vegetable and storage. hybrids of cucumber of foreign selection studied the following hybrids: Betina F1 (Dutch company Nunhems), Director F1 (Nunhems Netherlands), Kibria F1 (Rijk Zwaan - Netherlands), LenaraF1 - (Rijk Zwaan - Netherlands), Ecole F1 (Syngenta - Switzerland), which were sown in pots of 10 cm in diameter, seedlings at the age of 3-5 were planted on a test site. Experiment variants were placed by the method of full renomination. The area of the accounting plot is 90.0 m²: the length is 15.0 m; width 6.0 m; density 2.4 kg / m², planting plan 50 x 30, repetition of the experiment - 4-time, total number of plants - 210 pcs. Seeds were sown during the years of research on March 26. Accounting and observation were carried out in accordance with generally accepted methods [4]. Statistical processing of experimental data was carried out using the computer program "Statistica 6" using the method of dispersion analysis for Dospikhov (1985). Average samples of 2 kg fruit were taken from two non-adjointing repetitions. Biochemical analysis of cucumber fruits was carried out in the accredited laboratory IOB NAN, certificate number 100 - 226/2012 dated October 18, 2012, according to generally accepted methods and DSTU: dry matter content by drying out a forage at a temperature of 105 0C- GOST 28561-90; ascorbic acid - GOST 24556-89; Nitrates by potentiometric ion-selective method - DSTU 4948: 2008; total sugar - for (DSTU 4954: 2008) [2, 3].

Research results. In addition to the high productivity of plants, the chemical composition of the fruits plays an important role in assessing the cucumber, which varies considerably depending on the hybrid or variety, the conditions and the technology of their cultivation. It has been established that the characteristics, depending on the effect, have a significant influence not only on the formation of the level of productivity of field crops, but also on the indicators of its quality.

In the field experiment, a biochemical analysis of the fruits of the studied hybrids F1 cucumber was conducted (Fig. 1).

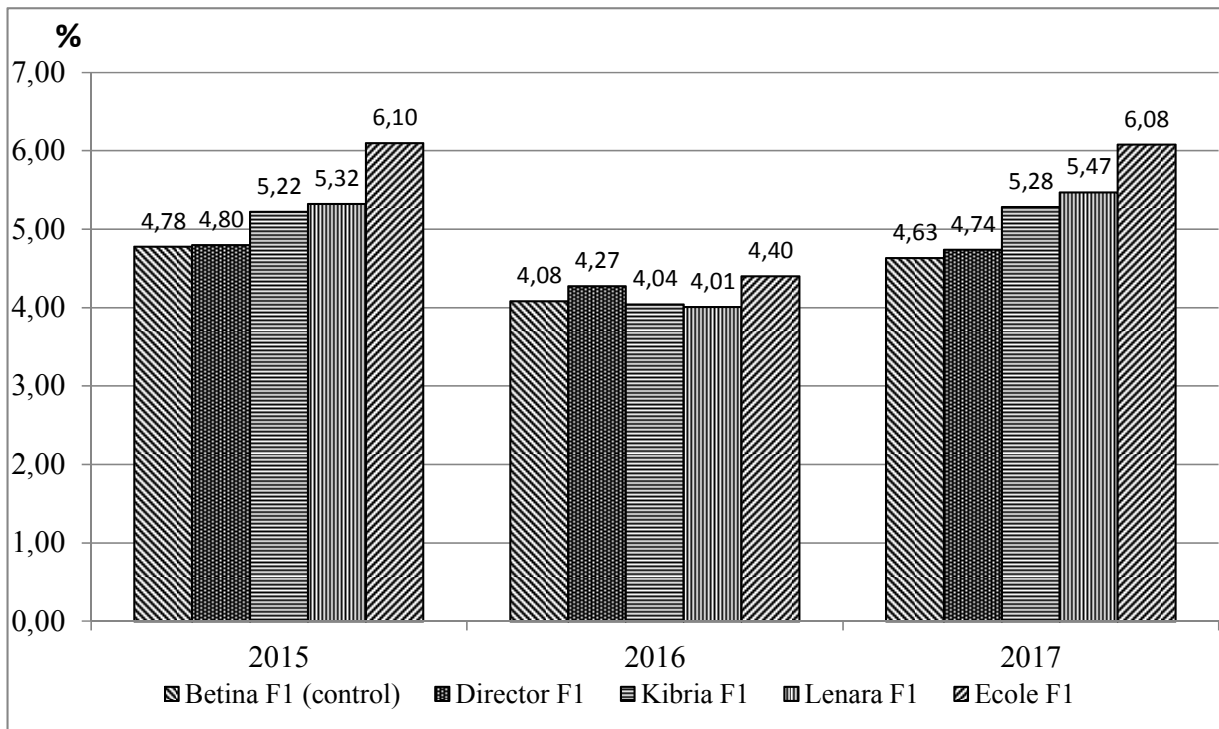


Fig. 1. Content of dry matter in fruits of hybrids F1 of cucumber of foreign selection (%), 2015-2017.

According to the analysis, it was determined that in 2015 the dry matter content of the studied hybrids F1 cucumber varied from 4.8 to 6.1%. In 2016, the content of dry matter in cucumber decreased by 0.5-1.7% compared with 2015 and amounted to 4.01-4.40%. It was only 0.32% higher than the F1 Ecole hybrid, while other hybrids were at the control level. The largest (6.1%) he was in the hybrid F1 Ecole. It is 1.32% more compared to Betina F1. In hybrids F1 of Kibria and Lenara there was a tendency for its significant increase by 0.44-0.54%, in comparison with the control. In the F1 Hybrid, the dry matter content of the fruit (4.8%) was at the control level. In 2017, the content of dry matter in cucumber fruit was greater than control in the F1 Ecole hybrid, by 1.45%; other hybrids also exceeded control, but to a lesser extent.

With an increase in the amount of dry matter, there was an increase in the content of total sugar in fruit cucumber from 2.40% to 2.76% and ascorbic acid from 8.91% to 10.1%. At the same time, the highest content of total sugar is 2.76% we have installed in the F1 hybrid and the ascorbic acid (9.36-10.1 mg / 100 g) in hybrids F1 Ecole and Lenara.

We analyzed the content of total sugars in the fruits of the studied F1 cucumbers hybrids (Fig. 2).

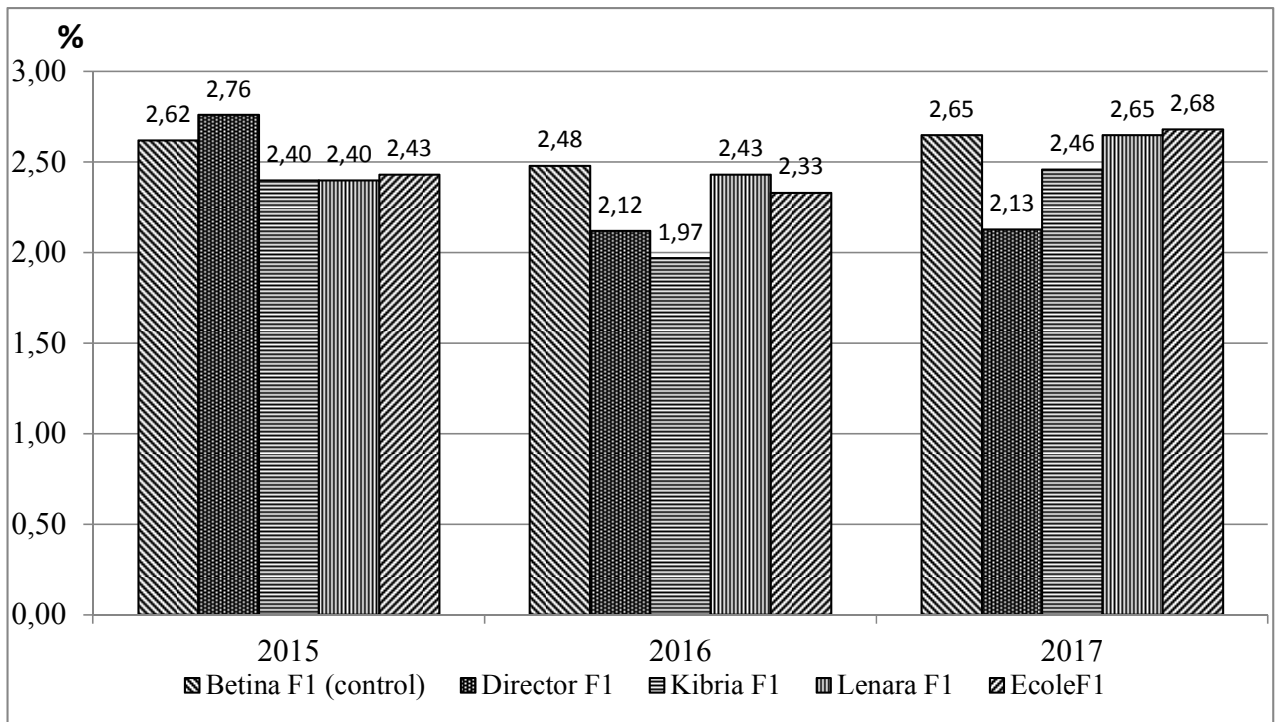


Fig. 2. Content of total sugar in fruits of hybrids F1 cucumber of foreign selection (%), 2015-2017.

The smallest content of total sugars (2.40-2.43%) was in the hybrids F1 of Kibria, Lenara and Ecole. The total content of cucumber in cucumber fruits in 2016 was also the lowest among the studied years and amounted to 1.97-2.48%, which is 0.1-0.6% less than in 2015. The largest (2.43-2.48%) content of total sugars was found in the F1 genuses of Lenara and Betina, and the smallest (1.97%) in the hybrid F1 of Kibria. The largest content of total sugar in cucumber fruits in 2017 was found in the F1 hybrids of Ecole, Lenara and Betina (2.68-2.65-2.65% respectively), the lowest in the F1 hybrid - 2.13%

An analysis of the content of ascorbic acid in the fruits of the studied hybrids F1 cucumber was performed (Fig. 3).

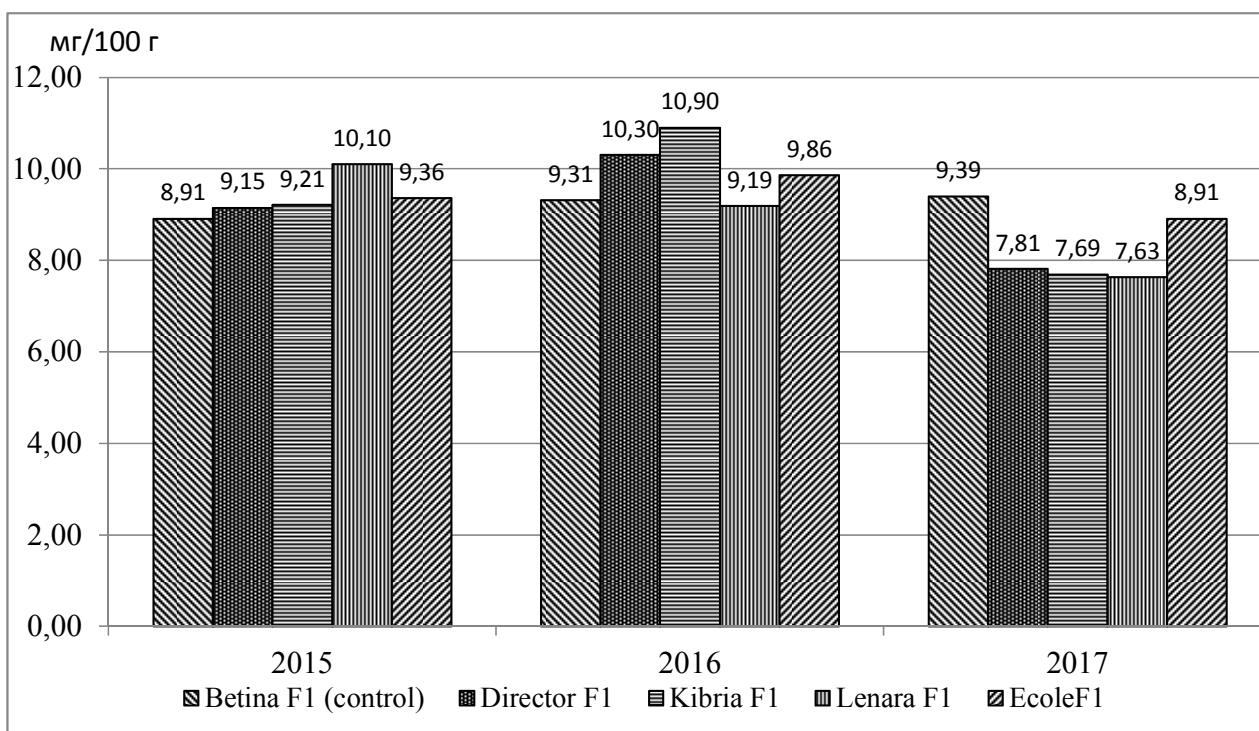


Fig. 3. The content of ascorbic acid in fruits of hybrids F1 of cucumber of foreign selection (mg / 100 g), 2015-2017.

In 2015, the smallest content of ascorbic acid (8.91, 9.15 and 9.21 mg / 100 g) will be in the F1 Betina, Director and Kibria, respectively. The leader of the F1 Lenara hybrid was 10.10 mg / 100 g. The content of ascorbic acid in cucumber fruits in 2016 was also the highest, among the studied hybrids during the years of the study and was 9.19-10.9 mg / 100 g, which is 0, 4-1.69 mg / 100 g more compared to 2015. The largest (10.3-10.9 mg / 100 g) of the ascorbic acid content we installed in the F1 hybrids of the Director and of Kibria respectively, and the smallest (9.19 mg / 100 g) in the F1 Lenara hybrid. The largest content of ascorbic acid in 2017, 9.39 mg / 100 g, was installed on the control in the F1 Betina hybrid, and the smallest in the Lenara F1 genova is 7.63 mg / 100 g.

The biochemical analysis of the fruits of the studied F1 cucumbers hybrids was conducted for the presence of nitrates in them (Fig. 4).

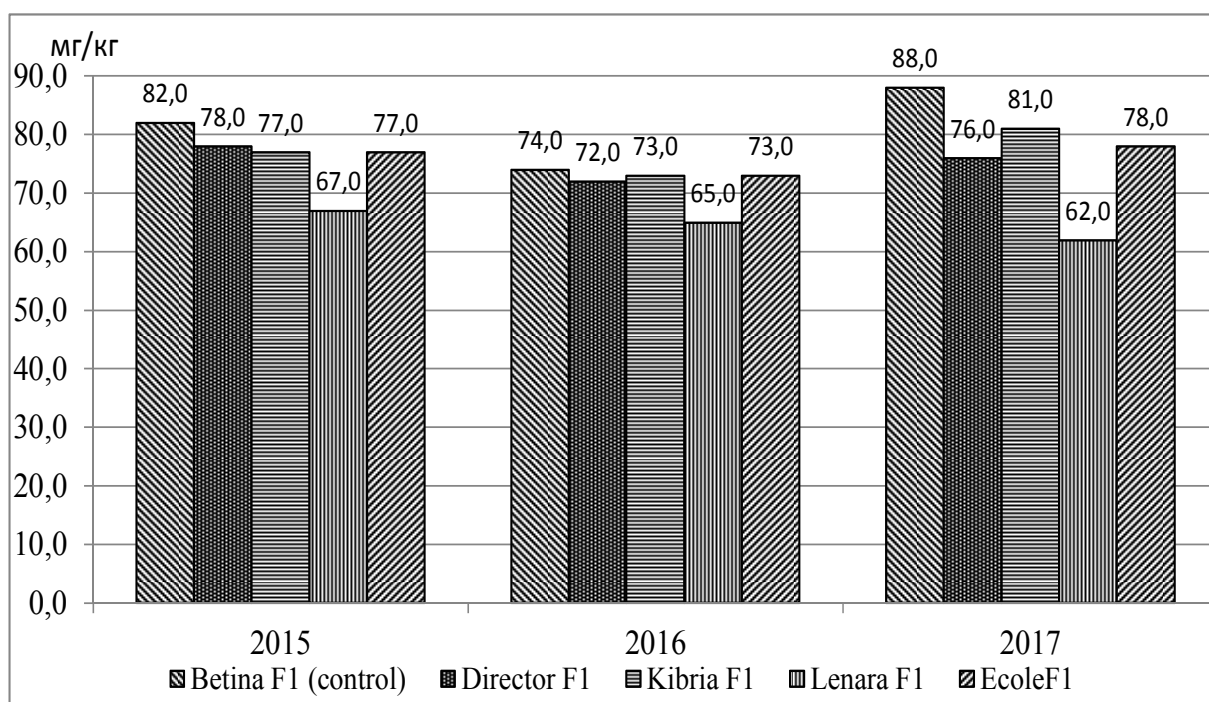


Fig. 4. The content of nitrates in the fruits of the studied hybrids F1 of the cucumber of foreign selection (mg / kg), 2015-2017.

The content of nitrates in cucumber fruits in 2015 varied from 67 to 82 mg / kg of crude and did not exceed the maximum permissible concentration - 400 mg / kg. The largest (82 mg / kg) he was under control in the F1 Betina hybrid. In other studied F1 hybrids, the content of nitrates was 67-78 mg / kg, which is 4 - 15 mg / kg less than control. The content of nitrates in cucumber fruits in 2016 also did not exceed the maximum permissible concentration and amounted to 65-74 mg / kg of crude mass. The content of nitrates in 2017 also did not exceed the maximum permissible concentration and amounted to 62-88 mg / kg of crude mass. The largest (88 mg / kg) he was in control at the F1 Betina hybrid.

The study of the correlation coefficients in the conducted field experiment showed that the relationships between the quantitative traits in their genotypic variability varied over the years (Table 1).

Table 1. Coefficients of correlation between the quantitative characteristics in hybrids F1 of cucumber of foreign selection for growing in film greenhouses, 2015-2017.

Hybrid	Dry substance, %	Total sugar, %	Ascorbic acid, mg / 100 g	N-NO ₃ , mg / kg crude mass (MAC - 400)
Betina F ₁ (control)	4,50	2,58	9,20	81
Director F ₁	4,60	2,34	9,09	75
Kibria F ₁	4,85	2,28	9,27	77
Lenara F ₁	4,93	2,49	8,97	65
Ecole F ₁	5,53	2,48	9,38	76

* Dependence is reliable at 5% level

The coefficient of partial correlation differs from the simple coefficient of linear pair correlation by the fact that it measures the pair correlation of the corresponding attributes (y and xi), provided that the influence on them of other factors (xj) is eliminated. Based on the calculated partial coefficients, we can conclude that the

inclusion of variables in the regression model is justified. As a result of calculations the equation of multiple regression was obtained: $Y = -21,5 + 0,50x_1 + 3,38x_2 - 0,078x_3$. The average calculated approximation error equals 1.16%. Determined corrected determination coefficient = 0,882. The statistical significance of the equation is verified using the determination coefficient and Fisher's criterion.

According to the results of our researches, the effective influence of the choice of hybrid F1 cucumber of foreign selection on the content of dry matter and basic chemical elements in the fruits of cucumber hybrids has been proved (Table 2).

Table 2. Chemical composition of fruits of hybrids F1 cucumber of foreign selection for growing in film greenhouses (average for 2015-2017)

Hybrid	Dry substance, %	Total sugar, %	Ascorbic acid, mg / 100 g	N-NO ₃ , mg / kg crude mass (MAC - 400)
Betina F ₁ (control)	4,50	2,58	9,20	81
Director F ₁	4,60	2,34	9,09	75
Kibria F ₁	4,85	2,28	9,27	77
Lenara F ₁	4,93	2,49	8,97	65
Ecole F ₁	5,53	2,48	9,38	76

In general, for 2015-2017, the dry matter content of cucumber was 4.50-5.53% on average. The highest content (5.53%) was attributed to the fruit of the F1 Ecole hybrid cucumber, and the smallest (4.50%) - on the control of the F1 Betina hybrid. The content of sugars in cucumber fruits, on average over the years of research, was 2.28-2.58%, and ascorbic acid - 8.97-9.38 mg / 100 g. The content of nitrates in cucumber fruits, on average, in 2015- In 2017, it was 65-81 mg / kg of crude weight, with a maximum allowable concentration of 400 mg / kg.

Conclusions.

During the study, the content of dry matter in the fruit of the cucumber was greatest in the hybrid F1 Ecole, other hybrids also exceeded the control, but to a lesser extent. In general, with an increase in the amount of dry matter, there was an increase in the content of total sugars and ascorbic acid in the fruits of cucumber. Among the studied F1 hybrids, Lenara and Ecole provided the highest content of sugars (2.49% in fruits of the F1 Lenara hybrid and 2.48% in fruits of the F1 Ecole hybrid), and ascorbic acid - 8.97 mg / 100 g and 9.38 mg / 100 g respectively. The content of nitrates in the fruits of cucumber, on average, during the study period fluctuated within 62-88 mg / kg of crude mass, with a maximum allowable concentration of 400 mg / kg. According to the results of researches of cucumber hybrids in the conditions of the left-bank forest-steppe of Ukraine in 2015-2017, high positive and reliable correlation coefficients between the content of dry matter and the content of ascorbic acid in cucumber fruits $r = 0.53$, ascorbic acid content and content of nitrates in cucumber fruits were established. $r = 0.70$. It is established that in the conducted field experiment 88,2% of the general variability is explained by the change of the investigated factors.

Thus, as a result of estimating the biometric characteristics of modern hybrids of cucumber of foreign selection, it is expedient to allocate F1 Lenara and F1 Ecole for growing them in film greenhouses.

Bibliography

1. Gil L.S. (2012) *Sovremennoe ovoshchevodstvo zakrytogo i otkrytogo grunta. Prakticheskoe rukovodstvo. [Modern vegetable growing of closed and open ground. A Practical Guide]*. Zhitomir: "Ruta". 468 p. (in Russian).

2. Gorovaya T.K (2002) Perechen GOSTov na metodiki izmereniy i analiza khimicheskogo sostava ovoshchnykh kultur i pochv. [*List of GOST controls for measurement and analysis of the chemical composition of vegetable crops and soils*]. Kharkov: IOB UAAN. 4 p. (in Russian).
3. Hrytsayenko Z.M. (2003) Metody biolohichnykh ta ahrokhimichnykh doslidzhen' roslyn i gruntiv. [*Methods of biological and agrochemical studies of plants and soils*]. Kiyv: ZAT NICH LAVA. 320 p. (in Ukrainian).
4. Dospekhov B.A. Metodika polevogo opyta. [*Methodology of field experience*]. Moscow: Kolos. 351. (in Russian).
5. Kravchenko V.A. (2008) Ohirok: selektsiya, nasinnytstvo, tekhnolohiyi. [*Cucumber: breeding, seed production, technology*]. Kiyv: EKMO. 176 p. (in Ukrainian).
6. Zemskova Yu.K., Baskova N.A., Bepalova I.S. et al. (2011). Ovoshchevodstvo: Metodicheskoe posobie. [*Vegetable farming: Methodical aid*]. Saratov: Izd-vo «KUBIK». 156 p. (in Russian).
7. Serhiyenko O.V., Korniyenko S.I., Radchenko L.O., Solodovnyk L.D. (2015). Osoblyvosti stvorenniya konkurentozdatnykh hibrydiv ohirka kornishonnoho typu z vykorystanniam novykh hinoetsiynykh liniy. Naukovo-metodychni rekomendatsiyi. [*Features of creation of competitive cognac hybrids with the use of new lines of guinea pigs. Scientific and methodological recommendations*]. Kharkiv: Instyt ovochivny`chtva i bashtanny`chtva NAAN. 28 p. (in Russian).
8. Potemkina L.V. (2007). Ogurtsy v naturalnom pitanii. [*Cucumbers in a natural food*]. Chelyabinsk: «Arkaim». 47 p. (in Russian).
9. Shulgina L.M. (Ed.). (1989). Spravochnik po ovoshchevodstvu zashchishchennogo grunta. [*Handbook of vegetable growing of protected soil*]. Kiev: Urozhay. 214 p. (in Russian).
10. Amri, E. (2014) The role of selected plant families with dietary Ethnomedicinal species used as anticancer. *Journal of Medicinal Plants Studies*, vol. 2, № 1, 28–39. (in English).
11. Mukherjee P.K., Maity N., Nema N.K., Sarkar B.K. (2011). Bioactive compounds from natural resources against skin aging. *Phytomedicine*. Vol. 19. P. 64–73. (in English).
12. Maheshwari R.K., Mohan L., Malhotra J. et al. (2014). Invigorating efficacy of *Cucumis sativas* for healthcare and radiance. *Inter. J. of Chem. and Pharm. Sci*, Vol. 2. № 3. P. 737–744. (in English).