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COMPARATIVE ANALYSIS, ADVANTAGES AND PROSPECTS OF OIL EXTRACTION TECHNOLOGIES FROM COTTONSEED OF COTTON VARIETIES IMPORTED FROM CHINA AND GROWN IN UZBEKISTAN

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Abstract. The article analyzes the oil content, fatty acid composition, oil extraction characteristics, and industrial prospects of cottonseed obtained from cotton varieties developed in Xinjiang, China, and cotton varieties grown in Uzbekistan. The study found that Chinese varieties are characterized by relatively high yield and oil content, while local varieties are well adapted to local climatic conditions and provide suitable raw material for processing. The prospects of new breeding varieties with high oil content and high oleic and linoleic acid levels were also evaluated.

Keywords: cotton, cottonseed, cottonseed oil, oil content, fatty acids, Chinese varieties, local varieties, breeding.

Annotatsiya. Maqolada Xitoyning Shinjon shahrida yetishtirilgan paxta navlaridan olingan paxta chigitining yog‘liligi, yog‘ kislotalari tarkibi, yog‘ olish xususiyatlari va sanoat istiqbollari tahlil qilingan. Tadqiqot shuni ko'rsatdiki, xitoy navlari nisbatan yuqori hosil va yog' miqdori bilan ajralib turadi, mahalliy navlar esa mahalliy iqlim sharoitiga yaxshi moslashgan va qayta ishlash uchun mos xom ashyo beradi. Yog 'miqdori yuqori, oleyk va linoleik kislota miqdori yuqori bo'lgan yangi naslchilik navlarining istiqbollari ham baholandi.

Kalit so'zlar: paxta, paxta chigiti, paxta moyi, yog' miqdori, yog' kislotalari, xitoy navlari, mahalliy navlar, naslchilik.

Аннотация. В статье анализируется содержание масла, состав жирных кислот, характеристики извлечения масла и промышленные перспективы семян хлопчатника, полученных из сортов хлопчатника, выведенных в Синьцзяне, Китай, и сортов хлопчатника, выращиваемых в Узбекистане. Исследование показало, что китайские сорта характеризуются относительно высокой урожайностью и содержанием масла, в то время как местные сорта хорошо адаптированы к местным климатическим условиям и обеспечивают подходящее сырье для переработки. Также были оценены перспективы создания новых селекционных сортов с высоким содержанием масла и высоким уровнем олеиновой и линолевой кислот.

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Ключевые слова: хлопок, семена хлопка, хлопковое масло, содержание масла, жирные кислоты, китайские сорта, местные сорта, селекция.

INTRODUCTION.

The continuous growth of the world's population, the acceleration of urbanization, and the increasing demand for healthy and balanced nutrition require an expansion of vegetable oil production. Vegetable oils are strategic products of the food industry and are a major source of unsaturated fatty acids essential for the human body. From this perspective, cottonseed is important not only as a valuable raw material for producing fiber for the textile industry, but also as an important resource for the oil and fat industry.

Cottonseed constitutes a major part of the total mass of the cotton crop and contains significant amounts of oil and protein. Cottonseed oil contains relatively high levels of biologically active unsaturated fatty acids such as linoleic and oleic acids. These fatty acids play an important role in preventing cardiovascular diseases, regulating cellular metabolism, and supporting human health.

In recent years, extensive research has been conducted in cotton-producing countries to develop and introduce high-oil varieties into production. In particular, modern cotton varieties developed in China's Xinjiang region have attracted attention because of their high yield, relatively high seed oil content, and industrially desirable characteristics. At the same time, local cotton varieties bred in Uzbekistan over many years are distinguished by their adaptation to drought, salinity, and sharp climatic changes. However, comparative studies of these varieties with foreign varieties in terms of seed oil content, fatty acid composition, and processing efficiency have not been sufficiently conducted.

The formation of cottonseed oil content is a complex biological process determined by genotype, environmental factors, and their interaction. While the genetic characteristics of each variety directly affect oil synthesis and fatty acid composition, environmental factors such as temperature, moisture, solar radiation, and soil fertility can alter the intensity of these processes. As a result, the same variety can demonstrate different oil-content values in different regions. Therefore, identifying high-oil varieties and placing them appropriately according to specific agro-climatic conditions is an important factor in increasing the efficiency of the oil and fat industry.

One of the current tasks facing Uzbekistan's oil and fat industry is to increase oil yield from cottonseed, improve product quality, and reduce processing costs. In addressing these tasks, an in-depth study of the biological and technological characteristics of varieties imported from China and local cotton varieties has

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important scientific and practical significance. Accordingly, this study comparatively analyzes the oil content of seeds obtained from Chinese and Uzbek cotton varieties, oil extraction efficiency, fatty acid composition, and industrial prospects.

2. RESEARCH OBJECT AND METHODS.

The following varieties were selected as research objects:
Chinese varieties: Xinluzhong-37, Xinluzhong-51, CCRI-70, Shida-K9.
Local varieties: S-6524, Bukhoro-102, Sulton, Khorezm-127.
Oil content was determined using Soxhlet extraction.

Cottonseed oil-content indicators. The average oil content of Chinese varieties was 24–25%, while that of local varieties was approximately 20–21%. Table 1 presents the analysis of the oil-content indicators of cottonseed from Chinese and local cotton varieties.

Table 1

Oil content of cottonseed from Chinese and local varieties

Variety	Oil content (%)
Xinluzhong-37	24.8
Xinluzhong-51	24.1
CCRI-70	23.6
Shida-K9	25.2
S-6524	20.4
Bukhoro-102	21.1
Sulton	20.8
Khorezm-127	20.2

The results show that the genetic characteristics of varieties have a significant effect on the process of oil accumulation. In Chinese varieties, oil content ranged from 23.6 to 25.2%, with an average of 24.4%. In local varieties, the indicator ranged from 20.2 to 21.1%, with an average of 20.6%.

According to the table, the highest oil content (25.2%) was recorded in Shida-K9. The high oil-accumulation capacity of this variety indicates that particular attention was paid to seed quality characteristics during the breeding process. Xinluzhong-37 and Xinluzhong-51 also had oil contents of 24.8 and 24.1%, respectively, and can be considered promising raw materials for industrial processing.

Among the local varieties, the highest oil content was found in Bukhoro-102 (21.1%), while the lowest was observed in Khorezm-127 (20.2%). However, these varieties are distinguished by their adaptation to different soil and climatic conditions of Uzbekistan, yield, and high fiber quality.

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Comparison of the average values showed that the oil content of Chinese varieties was 3.8 percentage points, or approximately 18.4%, higher than that of local varieties. This difference is an important economic indicator for oil and fat enterprises because each additional percentage point of oil in processed raw material creates an opportunity to obtain additional finished product.

The table results also demonstrate the strong influence of genotype on cottonseed oil content. This expands the possibility of creating new breeding varieties adapted to Uzbekistan's conditions and characterized by high oil content through hybridization of high-oil Chinese varieties with local varieties.

Table 2 presents the relative amounts of palmitic, stearic, oleic, and linoleic acids, the main fatty acids in cottonseed oil.

Table 2

Analysis of the fatty acid composition of oil from Chinese and local cotton varieties

Indicator	Chinese varieties (%)	Local varieties (%)
Palmitic	21.5	23.1
Stearic	2.5	2.8
Oleic	19.3	17.1
Linoleic	55.2	53.8

Fatty acid composition is one of the main factors determining the nutritional value, oxidative stability, shelf life, and technological properties of oil.

According to the table, linoleic acid accounted for the largest share in the oils of both groups. Its content was 55.2% in Chinese varieties and 53.8% in local varieties. Linoleic acid belongs to the omega-6 group and is an essential fatty acid for the human body. Its higher proportion increases the biological and nutritional value of cottonseed oil.

The oleic acid content of oil from Chinese varieties was 19.3%, which was 2.2 percentage points higher than in local varieties (17.1%). A higher oleic acid content increases the oil's resistance to oxidation, slows the formation of peroxide compounds, and extends product shelf life. Therefore, oils obtained from Chinese varieties may have certain advantages during refining and storage.

Palmitic acid accounted for 21.5% in Chinese varieties and 23.1% in local varieties. Similarly, stearic acid was slightly higher in local varieties (2.8%) than in Chinese varieties (2.5%). These saturated fatty acids affect oil hardness and crystallization properties. Therefore, oils obtained from local varieties may have certain technological advantages in the production of structural fats, margarine, and confectionery fats.

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Overall evaluation of the fatty acid composition shows that oils from Chinese varieties have high nutritional and functional quality indicators, while local varieties may be effectively used for certain technological products because of their higher proportion of saturated fatty acids. Thus, the results of Table 2 show a higher proportion of unsaturated fatty acids in Chinese varieties and a relatively higher amount of saturated fatty acids contributing to structural stability in local varieties. This confirms that both gene pools have specific advantages for the oil and fat industry and indicates the need for targeted use of these characteristics in breeding work.

Figure 1 compares the oil-content indicators of cottonseed from cotton varieties imported from China and grown in Uzbekistan.

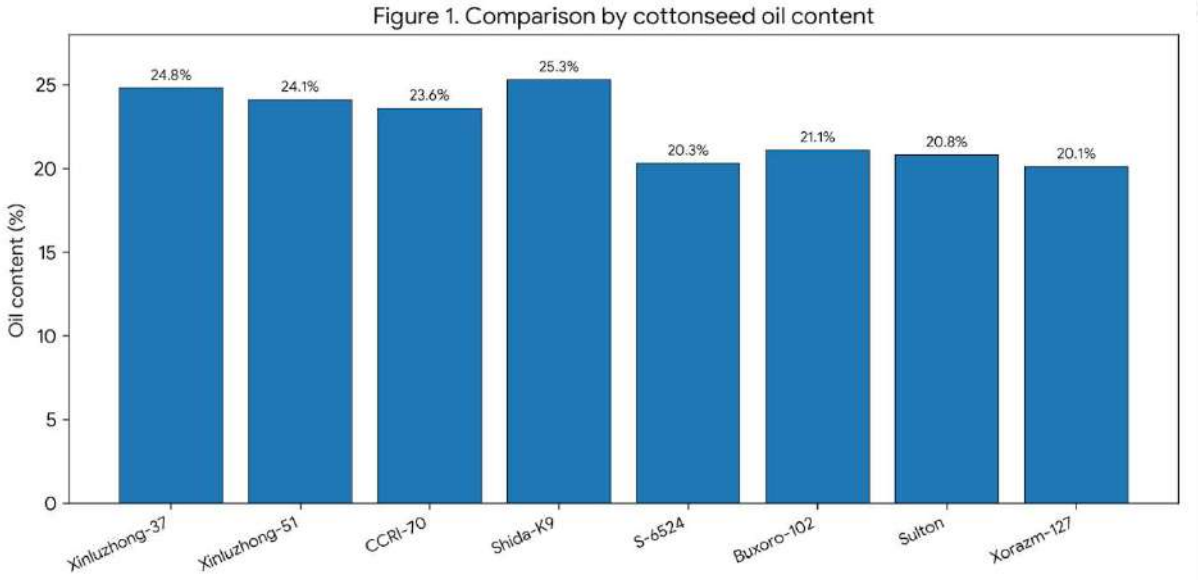


Figure 1. Analysis of the oil-content indicators of cottonseed from Chinese and local cotton varieties

According to the results, oil content in varieties of Chinese breeding ranged from 23.6 to 25.2%, with an average of 24.4%. In local varieties, the indicator ranged from 20.2 to 21.1%, with an average of 20.6%. The highest oil content was observed in Shida-K9 (25.2%) and the lowest in Khorezm-127 (20.2%). The difference between the average values was 3.8 percentage points, indicating that the oil content of Chinese varieties was approximately 18–19% higher than that of local varieties.

These results may indicate higher activity of genes responsible for lipid biosynthesis in Chinese varieties. Since increasing seed oil content was one of the main objectives in breeding these varieties, the metabolic processes associated with oil accumulation may proceed relatively intensively. In local varieties, breeding has mainly focused on yield, technological fiber quality, drought and salinity tolerance, while oil content has developed as a secondary characteristic.

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From an industrial perspective, this difference has important economic significance. For example, when 1,000 tons of cottonseed are processed, Chinese varieties may provide an opportunity to obtain an additional 35–40 tons of oil. This can increase enterprise profitability while reducing product cost. Therefore, testing high-oil Chinese varieties under local agro-climatic conditions and hybridizing them with the local gene pool is considered one of the promising directions.

Figure 2 shows the differences between Chinese and local varieties in the contents of the main fatty acids of cottonseed oil—palmitic, stearic, oleic, and linoleic acids.

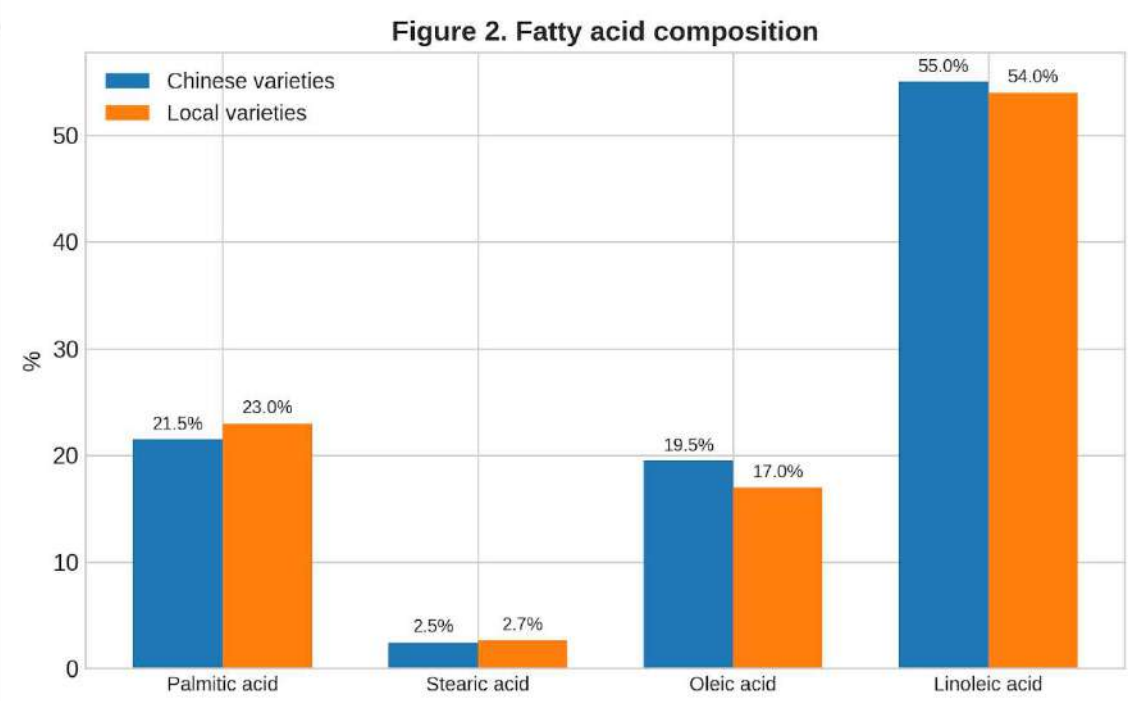


Figure 2. Analysis of the fatty acid composition of oil from Chinese and local cotton varieties

[Figure 2 from the source document is represented here by its caption; the original figure image was not available in the extracted document text.]

The analyses showed that linoleic acid accounted for the largest share in the oils of both groups: 55.2% in Chinese varieties and 53.8% in local varieties. Linoleic acid is an important unsaturated fatty acid belonging to the omega-6 group; it is not synthesized in the human body and must be obtained through food. Therefore, the high biological value of cottonseed oil is associated in part with this component.

Oleic acid content was 19.3% in Chinese varieties, higher than the 17.1% observed in local varieties. A higher oleic acid content increases resistance to oxidation, extends shelf life, and improves thermal stability during frying. This is an important technological advantage in the food industry.

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In local varieties, the proportions of palmitic (23.1%) and stearic (2.8%) acids were slightly higher than in Chinese varieties. These saturated fatty acids increase oil hardness and affect crystallization temperature. Consequently, oils obtained from local varieties may have certain advantages in the production of margarine and specialty fat products.

Analysis of fatty acid composition indicates that oils from Chinese varieties are promising nutritionally and functionally because of their higher oleic and linoleic acid contents. Local varieties may be important in technological processing, particularly in the production of structural fats and modified fat products. Overall, the results obtained from Figures 1 and 2 show certain advantages of Chinese varieties in terms of seed oil content and oil quality. At the same time, the ecological adaptability and technological characteristics of local varieties confirm the need to preserve them as valuable genetic resources for breeding. In the future, creating new cotton varieties with high oil content, high oleic acid content, and adaptation to local conditions on the basis of these two gene pools is one of the important scientific directions for developing the oil and fat industry.

Table 3 compares the quantities of major products obtained from industrial-scale processing of cottonseed from Chinese and local cotton varieties and the economic efficiency indicators.

Table 3

Analysis of the economic efficiency of processing cottonseed from Chinese and local cotton varieties

Indicator	Chinese varieties	Local varieties
Oil yield, t	240–250	200–210
Cottonseed meal, t	450–500	500–520
Revenue index	1.18	1.00

The analysis was carried out for processing 1,000 tons of cottonseed, and the results clearly demonstrate the relationship between varietal oil content and processing efficiency. According to the table, 240–250 tons of oil can be obtained from the seeds of Chinese varieties, whereas the corresponding figure for local varieties is 200–210 tons. On average, Chinese varieties can provide up to 40 tons more oil than local varieties. This is explained by their higher oil-content indicators and creates an important economic advantage for processing enterprises.

An increase in oil production directly affects the enterprise's total revenue because cottonseed oil is a major finished product of the oil and fat industry and represents a large economic share of product value. Consequently, when the same

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amount of raw material is processed, Chinese varieties create an opportunity to obtain greater economic returns.

The table also compares cottonseed meal yield. Local varieties produce 500–520 tons of meal, slightly more than Chinese varieties, which produce 450–500 tons. This can be explained by the relative reduction in the share of residual dry matter as the oil content of the seed increases. However, cottonseed meal is a protein-rich feed product widely used in livestock production. Therefore, the higher meal yield of local varieties represents a certain advantage from the perspective of feed production.

The revenue-index analysis indicates higher economic efficiency for Chinese varieties. The table gives an index of 1.18 for Chinese varieties, while the local varieties are conventionally assigned 1.00. This means that, under the conditions assumed in the study, economic efficiency of production based on Chinese varieties is approximately 18% higher. This result is primarily associated with higher oil yield and a larger volume of finished product.

In addition, the use of high-oil varieties may reduce energy consumption, increase extraction-process efficiency, and help optimize production costs. At the same time, when using imported varieties, seed costs, degree of adaptation, and agronomic risks should also be considered.

Overall, the results of Table 3 indicate that processing cottonseed from Chinese varieties has high economic efficiency. Local varieties, however, are distinguished by higher meal yield, good adaptation to agro-climatic conditions, and a stable raw-material base. Therefore, developing new breeding varieties that combine the high oil content of Chinese varieties with the adaptability of local varieties is one of the important directions for developing the oil and fat industry. This can contribute to increasing the volume of products obtained from cottonseed, producing import-substituting products, and supporting the country's food security.

CONCLUSION.

The analyses showed that the oil content of cottonseed obtained from Chinese varieties was on average 15–20% higher than that of local varieties, increasing oil-production efficiency. Local varieties, in turn, have advantages in agro-climatic adaptability and stability of the raw-material base. In the future, developing high-oil, high-oleic, and low-gossypol varieties based on Chinese and local gene pools is one of the important directions for developing Uzbekistan's oil and fat industry.

REFERENCES

1. To‘xtarov, N. (2018). Technologies for Processing Cottonseed. Tashkent: Academy of Sciences of Uzbekistan.

ISSN 3030-3907

2. Asqarov, R. (2017). Technological Foundations of Oil and Fat Production. Tashkent: Ministry of Higher and Secondary Specialized Education.
3. Aliyev, T. (2021). Oil-Producing Characteristics of Chinese Cottonseed and Opportunities in Uzbekistan. Tashkent: Center for Environmental Analysis.
4. Hamzayev, A. (2019). Improving the Efficiency of Processing Local Raw Materials. Institute of Journalism and Mass Communications.
5. Boboyev, X. (2020). Technical Cottonseed and Its Role in Oil Production. Tashkent: Association of the Oil and Fat Industry.
6. Yunusov, K. (2017). Cottonseed and Its Oil-Producing Characteristics. Tashkent: Association of Oil and Fat Producing Enterprises of Uzbekistan.
7. Tashmurodov A.N., Kuzibekov S.K., Fayzullayev A.Z. Analysis of the Quality Indicators of Cottonseed from New Foreign Varieties // Central Asian Food Engineering and Technology, Volume 3, Issue 9, October 2025, ISSN: 2181-385X, pp. 96–103.
8. Abdurakhimov A.A., Serkaev K.P., Kadirov Yu.K. System Analysis of the Technological Line for Refining Cotton Miscella // Chemistry and Chemical Technology. Tashkent, 2013, No. 2, pp. 66–69.
9. Abdurakhimov A.A., Kadirov Yu.K., Serkaev K.P. Development of the Technological Line for Refining Cotton Miscella Using Hydration and Electromagnetic Treatment Processes // Oil and Fat Industry. Moscow, 2014, No. 4, pp. 16–19.
10. Dai, J. and Dong, H. (2014). Intensive cotton farming technologies in China: Achievements, challenges and countermeasures. Field Crops Research, 155, pp. 99–110.
11. Halimova O‘.X. Plant Oil Production Technology. Tashkent: O‘qituvchi, 1982.
12. K. X. Majidov. Method of Cottonseed Oil Refining. Maslojirovaya Promyshlennost, 6 (2008): 23–24.
13. Technologies for Preliminary Refining of Cottonseed Oil Using Treatment with an Alkali Solution / S.Sh. Ismatov, M. Khayrilloev. Journal Voprosy Nauki i Obrazovaniya, No. 1 (2), Moscow, 2017, pp. 47–48.
14. K. X. Majidov. Refining of Extraction Cottonseed Oil. Maslojirovaya Promyshlennost, 4 (2011): 19–20.
15. Asqarov X.A. Technology of Fats and Oils. Tashkent.
16. A. T. Ruziboyev, A. A. Abdurahimov, Y. Q. Qodirov. Refining and Catalytic Modification of Fats. Textbook. Tashkent, 2020.
17. R. M. Nazirova, M. X. Xamroqulova, N. B. Usmonov. Technology of Storage and Processing of Oilseed Crop Seeds. Study Guide, 2021.
18. Xo‘jaqulova D. J. Abstract of Dissertation: Improving the Technology of Deodorization of Vegetable Oils. Bukhara, 2020.

ISSN 3030-3907

19. Handbook on the Technology of Production and Processing of Vegetable Oils and Fats. Edited by Prof. A.G. Sergeev. Leningrad: VNIIZh, Vol. II, 1973, 348 p.
20. Mamajanova I.R., Madatov R.Kh. Advantages of Local Adsorbents in Cottonseed Oil Refining // Universum. Technical Sciences, 2020, No. 11(80), pp. 78–81.
21. Abdurakhimov S.A., Bakhtiyarov S.B., Salimov Z.S. et al. Evaluation of the Degree of Oil Bleaching and Selectivity of Adsorbent toward Accompanying Triacylglycerol Substances // Uzbek Chemical Journal. Tashkent, 1998, No. 1, pp. 66–69.
22. Kadirov Z.Z., Buranova D.Ya. Study of Safety Criteria for Extracted Cottonseed Oil // Universum. Technical Sciences, 2021, No. 10(91), pp. 5–7.
23. Kodirov Z.Z., Kodirova Z.A. Effect of Moisture during Storage of High-Quality Refined, Deodorized Cottonseed, Sunflower and Soybean Oils // Universum: Technical Sciences, 2020, 10(79). URL: https://7universum.com/ru/tech/archive/item/10812 (accessed 29.09.2021).
24. Usmanov B.S., Kodirov Z.Z. Effect of Sunlight on the Composition of Products during Storage of High-Quality Vegetable Oils // Universum: Technical Sciences, 2021, No. 2-2 (83).
25. Li H., Chen Q., Zhou X. Utilization of Chinese cotton germplasm in international breeding programs // Plant Breeding Reviews, 2023, Vol. 47, pp. 85–110.
26. Xu Q., Li H., Zhou X. Elite Chinese cotton varieties: contribution to global cotton breeding // Plant Genetic Resources, 2020, Vol. 18, pp. 50–62.

ISSN 3030-3907