A bibliographical analysis of papers of cotton-picking machinery for the period 1972-2023 on Scopus database

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Abstract. This paper presents a bibliographical analysis of scientific research on cotton-picking machinery, focusing on countries, years, authors, and publishers involved in this field. The study utilizes materials from the Scopus database, describing the sequence of analyses and presenting the results through graphs and histograms. Cotton is a crucial product for human life, and its ecologically clean demand is increasing yearly. Traditional cotton growing remains relevant in Uzbekistan, where cotton picking by machine is essential due to labor-intensive and expensive manual methods. The international cotton industry actively participates in creating and using cotton-picking machines, with more than 90 countries growing cotton on 32 million hectares, including Uzbekistan's 1.07 million hectares. Since the 1970s, the USA and Uzbekistan have been the primary countries improving cotton-picking machines based on scientific and practical research. However, by the 21st century, countries like China, India, Turkey, and Israel have joined this field. This study aims to ensure that cotton-picking machines produced in Uzbekistan meet state standards by analyzing scientific research in this field, studying the advantages and disadvantages of machines from various countries, and staying updated on the latest developments through the Scopus database.

1 Introduction

Agriculture has been one of the most important and central branches of industry throughout human existence. Because the primary necessity for human life is food and clothing products. Cotton is one of those necessary products. According to the information presented in the annual newsletter of the International Cotton Advisory Committee (ICAC), the demand for ecologically clean cotton and its products is increasing every year [1,2].

Traditional cotton growing remains one of the leading directions of agricultural production in the Republic. Due to the labor-intensive and expensive process of picking cotton raw materials, picking cotton by machine does not lose its relevance [3]. According to

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the information of the International Cotton Advisory Committee, 30% of the world's raw cotton is picked by machines, and the cost of picking cotton from 1 hectare is 80-225 US dollars, depending on the size of the cotton grown and harvesting methods, and in some cases it reaches 470 US dollars. Therefore, in addition to our republic, the USA, China, Israel, Russia, Australia, Argentina, and Turkey actively participate in the creation, creation and use of cotton picking machines [1,3]. Currently, more than 90 countries of the world are engaged in growing cotton on a total area of 32 million hectares. Uzbekistan has 1.07 million hectares of cotton fields, and it ranks fourth after India, China and the United States [1,2,4].

A number of technical tools for planting, growing and harvesting cotton were invented. In particular, spindle type machines, especially machines with a vertical spindle, were created in the UZSSR, and the production of such machines is continued today at the "Tashkent Agricultural Plant". At that time, the USA, which was in competition with the Soviet Union in every field, created its own horizontal spindle machine [4]. Since the creation of such machines, mainly these two countries have been improving cotton picking machines based on their scientific and practical research in this field. In those days, other than these two countries, almost no other countries dealt with cotton picking machines [3,4]. By the 21st century, with the development of technology, countries such as China, India, Turkey and Israel have joined the ranks of countries engaged in this field. Today, a number of scientists are conducting research in the field of cotton-picking machines [3,4,7,8,9] in order to ensure that the cotton-picking machines produced in our country [5] and [6] meet the requirements of the state standard. Analyzing the scientific research carried out in this field in the above-mentioned and other similar countries, studying the advantages and disadvantages of the machines created in them is a very important and urgent task for creating competitive cotton-picking machines in open market conditions. With this in mind, we turned to the Scopus database to keep up with the latest developments in this field. We analyzed the materials on cotton picking machines in it. The data analysis is detailed in the following sections.

2 Methods

As a research method, the articles of the authors of [10] and [11] were selected as samples. To search for data, we begin by searching the Scopus database for materials using keywords. In this case, we entered the Scopus database and entered the words in the search menu. We have selected relevant areas through the filter. We have also selected a cross-section of the materials we are looking for from him. Figure 1 below is a block diagram representing the sequence of this process.

During the research, a total of 593 publications were obtained, and the collected data were analyzed and displayed on maps using MS Excel and software. Mapchart.com was used to draw the map. Using the ALL-search parameter in Scopus, it can include all the fields you want for your search, including the title, abstract, keywords, affiliation, funding information, reference information, and conference information.

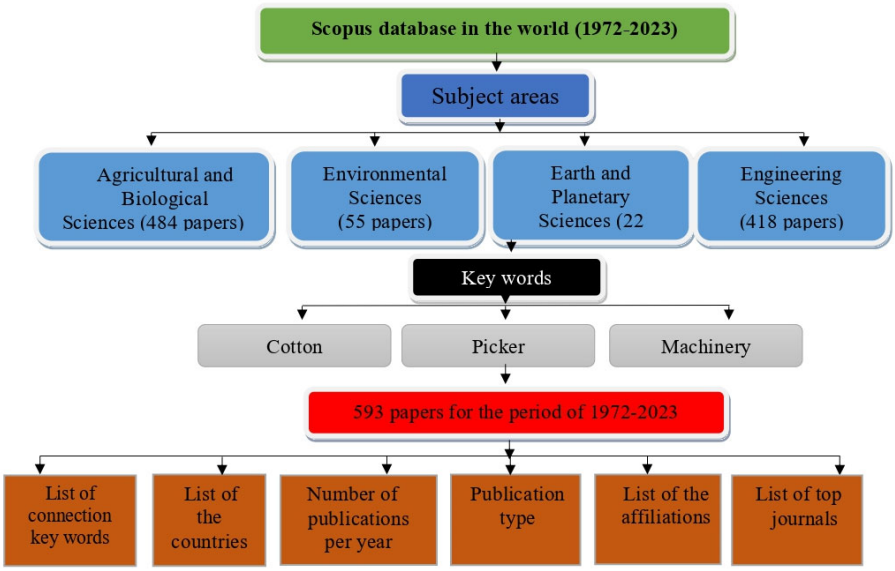

Fig. 1. Methodology flowchart for the research.

3 Results and discussion

When we searched the data through the above parameters, it was found that a total of 593 scientific works are available in the database. Now we will analyze these 593 scientific works according to various indicators.

1. Let's get acquainted with the countries currently operating in this field. 1972-2023 on the map below. The number of scientific works published in the field of cotton picking machines is given by country. As can be seen from the map, the most scientific researches in this field are conducted by Chinese scientists. Uzbekistan ranks 4th in this field after China, USA and India.

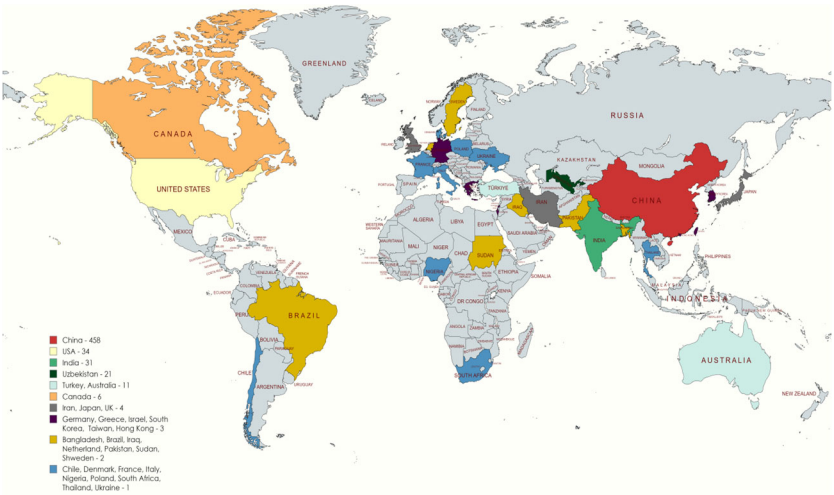

Fig. 2. Countries conducting research in the field of cotton-picking machines and the number of scientific works in them between 1972 and 2023 (based on the Scopus database).

As can be seen from the map, about 78% of the total of 593 scientific works correspond to China. China, like other industries, is striving for leadership in cotton production and cotton picking machinery. This is especially reflected in recent years.

2. And now we will analyze the weight of scientific research in terms of years. We also rely on Scopus database materials. The following histogram shows the number of scientific papers published by year.

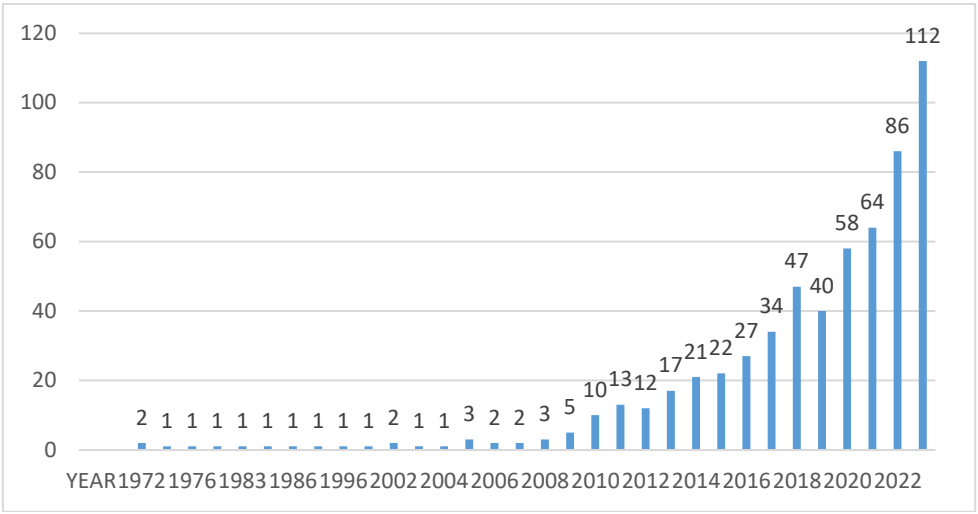

Fig. 3. The number of scientific works in the field of cotton picking machines (by years).

As can be seen in the histogram, interest in this field has been increasing since the beginning of the 2000s. In 2023 alone, 112 scientific works were published. This is equal to about 20% of the total articles of this period.

3. Now we will analyze to which type the 593 scientific works obtained as a result of the search belong. The result is shown in the histogram below.

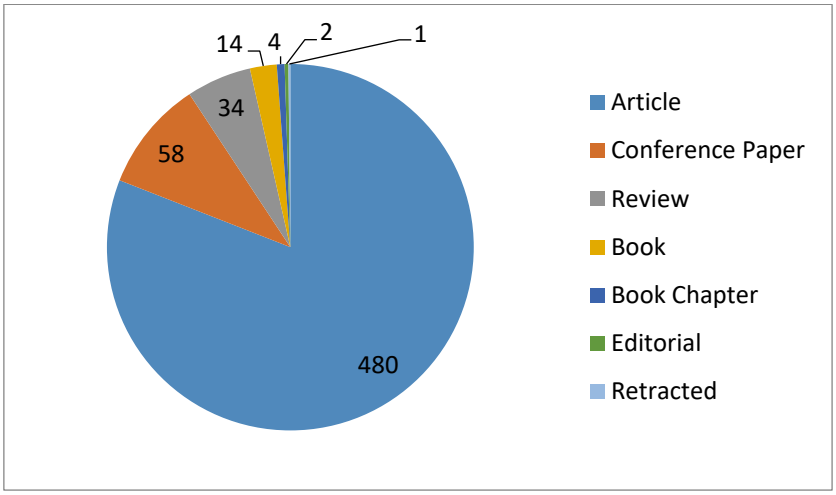

Fig. 4. Distribution of scientific works by types.

As can be seen from the diagram, the main part of scientific works (more than 80% of total works) is published in the form of articles.

4. In addition to the above, we also analyzed organizations operating in this field. According to this indicator, the main places are occupied by China, followed by India and a number of organizations of the USA. Taking into account the large amount of information on this indicator, we decided to show only the results of the work of scientists of our country. According to this rating, 3 organizations in Uzbekistan deal with cotton picking machines out of a total of 168 organizations in the world. Their names and ranking indicators in this Scopus database are listed in Table 1 below.

Table 1. The number of organizations active in the field of cotton picking machinery and the materials published by them.

№	Name of the organization	Number of materials
1	Ministry of Agriculture of the People's Republic of China	70
2	Shihezi University	59
3	China Agricultural University	54
4	Xinjiang Agricultural University	36
5	Ministry of Education of the People's Republic of China	22
6	Nanjing Agricultural University	20
7	Huazhong Agricultural University	20
8	Shandong Agricultural University	18
9	Northwest A&F University	16
10	Jiangsu University	15
11	Xinjiang Academy of Agricultural Sciences	15
12	Chinese Academy of Agricultural Mechanization Sciences	14
13	Tarim University	14
14	South China Agricultural University	13
15	Zhejiang Sci-Tech University	13
16	Punjab Agricultural University	11
17	Academy of Sciences of the Republic of Uzbekistan Institute of Mechanics and Seismic Stability of Structures named after M.T.Urazbaev	11
[a] Academy of Sciences of the Republic of Uzbekistan Institute of Mechanics and Seismic Stability of Structures named after M.T.Urazbaev - 17 places; [b] Tashkent Institute of Irrigation and Agricultural Mechanization National Research University - 22 places; [c] Tashkent State Technical University - 51 places.		

Organizations financing scientific, practical and innovative developments in this field were also analyzed. According to the Scopus database, we can see that the Ministry of Innovative Development (now known as Science and Innovation) of the Republic of Uzbekistan is the only organization that finances the field of cotton growing and its mechanization in Uzbekistan. According to this indicator, the Ministry of Innovative Development ranks 79th out of a total of 106 organizations.

5. Now we will analyze the sources with the most material in the field of cotton picking machines. There are a total of 123 sources for this ranking indicator. The most important 18 of them, i.e. publications containing more than 5 scientific works and the number of materials in them, are listed in Table 1 below.

Table 2. The number of organizations active in the field of cotton picking machinery and the materials published by them.

№	Publisher Name	Number of materials
1	Nongye Gongcheng Xuebao Transactions Of The Chinese Society Of Agricultural Engineering	126
2	Nongye Jixie Xuebao Transactions Of The Chinese Society For Agricultural Machinery	97
3	Agriculture Switzerland	26
4	International Agricultural Engineering Journal	23
5	Journal Of Chinese Agricultural Mechanization	16
6	Computers And Electronics In Agriculture	14
7	Agronomy	9
8	International Journal Of Agricultural And Biological Engineering	9
9	Iop Conference Series Earth And Environmental Science	9
10	AMA Agricultural Mechanization In Asia Africa And Latin America	8
11	Nongye Jixie Xuebao Transactions Of The Chinese Society Of Agricultural Machinery	8
12	E3s Web Of Conferences	7
13	Inmateh Agricultural Engineering	7
14	Biosystems Engineering	6
15	Agriengineering	5
16	Applied Engineering In Agriculture	5
17	Applied Sciences Switzerland	5
18	Sensors	5

The number of articles in the rest of the resources ranges from 1 to 4. It should be mentioned that there is no such international level resource in Uzbekistan.

4 Conclusion

According to the analysis materials, China is the only country in Central Asia that ranks 4th after the USA and India in terms of copied scientific works.

Uzbekistan does not have its own international standards for cotton picking machinery. But it has its place in other international publications. In particular, in the list of organizations financing the sector, the Ministry of Innovative Development of the Republic of Uzbekistan (currently called Science and Innovation) ranks 79th out of 106 organizations, according to the number of article citations in the Scopus database:

a) Institute of Seismic Strength of Mechanics and Structures of the Federal Republic of Uzbekistan - 17 places;
b) Tashkent Institute of Irrigation and Agricultural Mechanization National Research University - 22 places;
c) Tashkent State Technical University - 51 places.

The analysis of the number of articles published over the years showed that the number of researchers engaged in scientific activity in this field is increasing year by year. Of course, the contribution of our country's scientists is great.

The article was written basic on the innovative project of the Ministry of Innovative Development of the Republic of Uzbekistan AL-210202547 "Production and creation of an energy-efficient universal pneumatic transport system for multi-row cotton-picking machines", and the authors express their gratitude to the Ministry.

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