Selcuk Journal of Agriculture and Food Sciences

http://sjafs.selcuk.edu.tr/sjafs/index

Research Article

Selcuk J Agr Food Sci

(2023) 37(1), 12-18

e-ISSN: 2458-8377

DOI: 10.15316/SJAFS.2023.002

Determination of Agricultural Mechanization Level of Azerbaijan in Plant Production

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HIGHLIGHTS

- The situation of the agricultural mechanization in Azerbaijan was discussed.
- Change of agricultural mechanization status by years in Azerbaijan was determinated.

Abstract

Agricultural mechanization characteristics of Azerbaijan were investigated in this study. Based on the statistical data of Azerbaijan, number of tractors, number of agricultural tools and machines and agricultural mechanization level indicators were calculated and summarized. Respectively in the years 2010 and 2021, average tractor power was identified as 68.2 and 74.7 HP, tractor power per cultivated area as 916 and 1672.2 HP/ha, number of tractors per 1000 hectares as 13.4 and 22.2, number of combine harvesters per 1000 hectares as 1.2 and 2.1, cultivated area per tractor as 75 and 45 ha, cultivated area per combine harvester as 821.5 and 458.3 ha, agricultural field per capita as 0.52 and 0.47 ha and finally number of people per unit area as 1910 and 2120.

Keywords: Azerbaijan, Mechanization level, Tractor, Combine harvester

1. Introduction

Increasing world population and decreasing natural resources threaten all countries. Besides all these, negative factors such as pandemic and wars that have emerged in recent years have once again revealed the importance of food in human life. Food products are obtained from animal and plant sources. In this sense, it has become necessary to increase productivity in plant production activities, especially in declining agricultural areas. Efficiency can be analyzed in two parts as product efficiency (product quantity per unit area) and improvements to be made in input costs. Agricultural mechanization provides significant time savings at every stage of production, reduces human labor and energy costs in agricultural activities. Mechanization also plays an important role in yield and quality. Therefore, within the scope of agricultural activities, increasing the level of agricultural mechanization should be among the priority strategic objectives of all countries.

Citation: Hakhiyev J, Şeflek AY (2023). Determination of agricultural mechanization level of Azerbaijan in plant production. *Selcuk Journal of Agriculture and Food Sciences*, 37(1), 12-18. https://doi.org/10. 15316/SJAFS.2023.002

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Received date: 16/11/2022

Accepted date: 26/12/2022

Agricultural mechanization with a great role in increasing productivity in agricultural activities is an indispensable factor for the sustainability of agriculture. Increasing agricultural mechanization allows farmers to do agriculture over larger areas and contributes to social, cultural and economic development of the population engaged in agriculture (Özpınar, 2001; Demir and Çelen, 2006).

Mechanization also plays an important role in improving production, productivity and quality in agriculture, facilitating agricultural activities, minimizing existing costs, modernizing enterprises, opening new business areas, and developing the agricultural sector socio-economically (Altay and Turhal, 2011). Agricultural mechanization, which is an indispensable input of modern agricultural techniques, requires good planning because it is expensive and long-term investment. Therefore, agricultural mechanization status and problems should be adequately revealed on a national and regional basis (Baydar and Yumak, 2000).

Within the scope of this study, tools and machinery used in plant production, especially tractor and harvester inventory of Azerbaijan were investigated and mechanization level indicators were calculated and evaluated in Tables and charts.

2. Materials and Methods

Azerbaijan is a Eurasian country located in the South Caucasus. Its location is Eastern Europe and Southwest Asia. It is located between 38° and 42° north latitudes and 44° and 51° east longitudes. The length of its borders is 2648 kilometers of which 1007 kilometers with Armenia, 756 kilometers with Iran, 480 kilometers with Georgia, 390 kilometers with Russia and 17 kilometers with Turkey. Azerbaijan has a coastline of 800 kilometers and the widest border length of the Azerbaijani part of the Caspian Sea is 456 kilometers. The country's territory stretches for 400 kilometers from north to south and 500 kilometers from east to west.

Azerbaijan harbors a wide natural diversity. Although it is surrounded by mountains and high hills, most of Azerbaijan is plain and the most fertile parts of its land are the delta where the Kura and Aras rivers mix. There is a temperate climate in Azerbaijan, but a harsh climate is encountered toward inward from the Caspian Sea, in the high mountains and other high parts. In higher elevations, winters are long, cold and snowy and summers are cool. On the plains, winters are cool and rainy and sometimes snowy and summers are hot and dry.

The plains of Azerbaijan are mostly steppes and 25% are covered with forests, some of which are mountains. Forests are seen in the northern and southern parts of the mountains up to 2000 m altitudes (Anonymous, 2022a).

The annual average temperature of Azerbaijan is 14.5 °C. Average annual precipitation in Azerbaijan varies from region to region. The annual total average of precipitation varies between 110 kg/m² (Puta town) to 1750 kg/m² (Kekiran, Lenkeran). Atmospheric precipitation is one of the main factors of weather and climate, but it is also of great importance for agriculture (Mammadov, 2003).

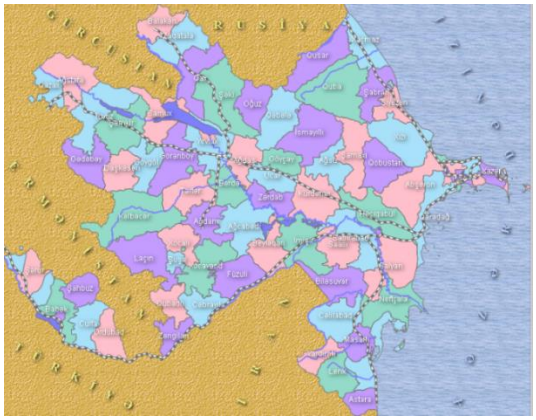

Figure 1. Azerbaijan map and terrestrial bordering countries (Anonymous, 2022b).

Figure 2. Location of Azerbaijan in the world (Anonymous, 2022c).

Various research methods are used to determine the mechanization level of a country or a region. The most widely used of these methods are tractor power per unit area (kW/ha), agricultural area per tractor (ha/tractor), number of tractors per unit agricultural area (tractor/1000 ha). The other criteria used in determining the level of mechanization include the mass of agricultural machinery per tractor, the energy variety used in the agricultural sector, the tractor usage time and the tractor purchasing power of the producers (Pınar et al., 1994; Ülger et al., 2002; Işık et al., 2003; Arıöz, 2007; Yıldız et al., 2007; Koçtürk and Avcıoğlu, 2007; Lüle et al., 2012).

Several studies have been conducted in Turkey to determine agricultural mechanization levels. In a study conducted to determine the agricultural mechanization level of Nevşehir province, it was determined that the number of tractors per 1000 ha in Nevşehir was 50.28 in 2003 and 48.39 in 2012 (Eryılmaz et al., 2013). In another study, the agricultural mechanization level of Kırıkkale province was investigated and it was concluded that the average tractor power was 40.41 kW in 2003 and 36.74 kW in 2012 (Yeşilyurt, 2013). In a study analyzing the agricultural mechanization status of Hakkari province, the cultivated area per tractor in Hakkari was determined as 61.84 ha in 2003 and 56.66 ha in 2012 (Gökdoğan, 2014).

Within the scope of this study, the data obtained from the Azerbaijan State Statistical Institute were used, evaluations were made and results were presented in tables and graphs. Changes in the number of combine harvesters and tractors for the last 12 years and mechanization level characteristics were determined.

3. Results and Discussion

Within the scope of the data obtained from the Azerbaijan State Statistics Institute, number of tractors and total tractor powers of the last 12 years are given in Table 1.

When the data shown in Table 1 is examined, it was seen that number of tractors was 21258 in 2010 and 36808 in 2021. Considering the statistical data in the last 12 years, there were increases in number of tractors.

The total tractor power was 1451000 HP in 2010 and 2750000 HP in 2021. During this period, it was determined that there was an increase of 15550 units or 73.1% in the number of tractors, an increase of 1299000 HP or 89.5% in the total tractor power and an increase of 6.5 HP or 9.5% in the average tractor power.

According to Table 1, the average tractor power of Azerbaijan was 68.2 HP in 2010 and 74.7 HP in 2021. Considering the increase in average tractor power, it was understood that tractors entering the country in recent years had greater horsepower.

The change in the number of combine harvesters in Azerbaijan by years is presented in Table 2. When Table 2 is examined, it was determined that the number of combine harvesters in Azerbaijan was 1928 in 2010. Although there were increases and decreases in the number of combine harvesters between 2010 and 2021, the number of combine harvesters increased by 1560 and reached to 3588 by 2021. In addition, the amount of change in the number of combine harvesters between the years 2010-2021 was calculated proportionally and provided in Table 3.

Looking at Table 3, there were increases and decreases in the number of machines in the agricultural equipment-machine park in the last 12 years. According to Table 3, there were increases in number of tractors (73.1%), plows (67.6%), cultivators (72.3%), seeders (107.1%), mowers (95.7%), balers (13%), combine-harvesters (86%), combine-harvester compatible corn harvesters (20%), self-propelled cotton harvesters (2254%), self-propelled potato harvesters (295%), self-propelled sugar beer harvesters (1577), solid manure spreaders (462.5%), liquid manure spreaders (266%), while there was a decrease in the number of self-propelled forage harvesters (-20%).

According to Anonymous (2022d), the information presented in Table 4 revealed that the total lands given to agricultural use by the Azerbaijan State was 4766800 ha in 2010 and 4780600 ha in 2021. Not all of the lands reserved for agriculture were cultivated, total size of cultivated lands was 1842700 ha in 2010 and 2049800 ha in 2021.

In Table 4, the area per capita from the lands allocated for agriculture (person/ha) and the number of people per unit area allocated for agriculture (1000 ha/person) were provided.

According to the information presented in Table 5, the number of tractors per 1000 ha area (tractor/1000 ha) in Azerbaijan was 13.4 in 2010 and this figure increased to 22.2 in 2021. The total power per 1000 ha area (HP/1000 ha) of 916 HP in 2010 increased to 1672.2 HP in 2021. The cultivated area per tractor (ha/tractor) was 75 ha in 2010 and this number decreased to 45 ha in 2021.

According to the data shown in Table 5, the number of combine harvesters per 1000 ha area (harvester/1000 ha) was 1.2 in 2010 and this figure increased to 2.1 in 2021. In addition, the area per harvester (ha/harvester) was 821.5 ha in 2010 and it was observed that this area decreased to 458.3 ha in 2021.

When the Charts prepared in the light of the information obtained from the Azerbaijan State Statistics Institute were examined, it was seen that there has been a serious progress in the level of agricultural mechanization after 2015. The main reason for this is to support the development of agriculture and accelerate its modernization, to provide a systematic and complex approach to solving existing deficiencies in the agricultural sector, based on the 32nd paragraph of Article 109 of the Constitution of the Azerbaijan Republic, as a result of the great initiative shown by the President of Azerbaijan Ilham Aliyev to agriculture and to use the administrative and financial resources of the state efficiently in the sector. For this purpose, 2015 was declared the "Year of Agriculture" of the Republic of Azerbaijan in order to publicize the agricultural potential of Azerbaijan widely (Anonymous, 2015).

Table 1. Number of tractors, total tractor power (HP) and average tractor power (HP) of Azerbaijan for the last 12 years (Anonymous, 2022d).

Years	Tractors		
	Number of Tractors	Total Tractor Power (HP)	Average Tractor Power (HP)
2010	21 258	1 451 000	68.2
2011	21 404	1 464 000	68.3
2012	21 073	1 434 000	68
2013	23 469	1 630 000	69.45
2014	23 090	1 605 000	69.5
2015	12 262	775 000	63.2
2016	17 043	1 415 000	83.02
2017	21 787	1 585 000	72.8
2018	34 829	2 090 000	60
2019	34 936	2 441 000	69.9
2020	34 954	2 558 000	73.2
2021	36 808	2 750 000	74.7

Table 2. Distribution of a number of combined harvesters of Azerbaijan in the last 12 years (Anonymous, 2022d).

Years	Combine Harvesters
	Number of Combine Harvesters
2010	1 928
2011	1 776
2012	1 724
2013	2 143
2014	2 218
2015	658
2016	1 285
2017	1 621
2018	3 671
2019	3 817
2020	3 642
2021	3 488

The total tractor power was 1 451 000 HP in 2010 and 2 750 000 HP in 2021. During this period, it was determined that there was an increase of 15 550 units or 73.1% in the number of tractors, an increase of 1 299 000 HP or 89.5% in the total tractor power and an increase of 6.5 HP or 9.5% in the average tractor power.

According to Table 1, the average tractor power of Azerbaijan was 68.2 HP in 2010 and 74.7 HP in 2021. Considering the increase in average tractor power, it was understood that tractors entering the country in recent years had greater horsepower.

The change in the number of combined harvesters in Azerbaijan by year is presented in Table 2. When Table 2 is examined, it was determined that the number of combine harvesters in Azerbaijan was 1 928 in 2010. Although there were increases and decreases in the number of combine harvesters between 2010 and 2021, the number of combine harvesters increased by 1 560 and reached 3 488 by 2021. In addition, the amount of change in the number of combine harvesters between the years 2010-2021 was calculated proportionally and provided in Table 3.

Table 3. Number of agricultural tools and machines of Azerbaijan in 2010 and 2021 (Anonymous, 2022e).

Agricultural Tools and Machines	**2010**	**2021**	**Change ratio (%)**
Tractors	21258	36808	+ 73.1%
Plows	3344	5602	+ 67.6%
Cultivators	939	1618	+ 72.3%
Seeders	1844	3819	+ 107.1%
Mowers	873	1703	+ 95.7%
Balers	1501	1697	+ 13%
Combine harvesters	1928	3588	+ 86%
Combine-harvester compatible corn harvesters	5	6	+ 20%
Self-propelled forage harvesters	661	109	- 83%
Self-propelled cotton harvesters	22	496	+ 2254%
Self-propelled potato harvesters	20	59	+ 295%
Self-propelled sugar beer harvesters	9	142	+ 1577%
Solid manure spreaders	112	518	+ 462.5%
Liquid manure spreaders	624	1665	+ 266%

Table 4. Change of total agricultural land (ha), number of people per unit area and total cultivated land (ha) recorded at the end of the year (Anonymous, 2022e).

Self-propelled forage harvesters	661	109	- 83%
Self-propelled cotton harvesters	22	496	+ 2254%
Self-propelled potato harvesters	20	59	+ 295%
Self-propelled sugar beer harvesters	9	142	+ 1577%
Solid manure spreaders	112	518	+ 462.5%
Liquid manure spreaders	624	1665	+ 266%

Table 5. Change of tractor/1000ha, HP/1000ha, combine harvester/1000ha, ha/tractor, ha/harvester parameters of Azerbaijan between 2010-2021 (Anonymous, 2022e).

Years	Number of tractors per 1000ha land	Tractor power per 1000ha land (HP)	Number of combine harvester per 1000ha land	Land area per tractor (ha)	Land area per combine harvester (ha)
2010	13.4	916	1.2	75	821.5
2011	13.3	910.3	1.1	75	905.5
2012	12.8	870.6	1	78	955.3
2013	13.9	967.8	1.3	72	785.9
2014	14.3	994.5	1.4	70	727.5
2015	7.7	488.8	0.5	129	2409.4
2016	10.5	869.0	0.8	96	1267.1
2017	13.1	951.5	1	76	1027.5
2018	20	1202.5	2.1	50	473.4
2019	20.4	1421.5	2.2	49	449.8
2020	21.3	1568.4	2.2	47	447.8
2021	22.2	1672.2	2.1	45	458.3

Author Contributions: The authors have an equal contribution. All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest: The authors declare no conflict of interest.

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