

## DEVELOPMENT OF THE WALNUT SECTOR IN THE REPUBLIC OF MOLDOVA

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### Abstract

*The development of international trade with agri-food products imposes new requirements for increasing the economic efficiency for agricultural production. Currently, there is an increased interest among the entrepreneurs oriented towards the development of the walnut sector, which offers a high profitability and, based on these considerations, it is an important source for the small farmers to increase the income in the rural localities. The purpose of the research is to analyze the current state of development of the walnut sector in the Republic of Moldova and to forecast the development prospects for the coming years.*

**Key words:** value chain, strategy, export and import of nuts, profitability, sector development

### INTRODUCTION

The modernization of the walnut production sector in the Republic of Moldova into a competitive and efficient one requires considerable investment and adequate support from the state and donors. The diversification of production and production for export in the case of the walnut sector is a potential source of income generated from bringing currency into the country and increasing profits in rural areas.

The purpose of the research consisted in systematizing the information from the walnut sector and the current state of its development in the Republic of Moldova, as well as forecasting its prospects for sustainable development for the coming years.

### MATERIALS AND METHODS

The research carried out was based on the following sources of analysis: world data from the walnut industry and from the Republic of Moldova, as well as specialized literature in the field. Other sources are information collected from actors in the value

chains of the walnut production trade and sectoral information of agricultural producers. The methodology used in the analysis of the walnut sector consisted of the use of statistical and calculation data of the current and future development of the given sector elaborated by the group of authors.

### RESULTS AND DISCUSSIONS

The marketing of walnuts is much more advantageous and this is explained by the fact of the increased interest in international markets and the deficit of walnut kernel. In the case of walnuts in the Republic of Moldova, the traditional export market is the EU, but it is exported stable in the east as well. The EU market will remain a core customer and continue to be, but other new markets in Asia should not be neglected, for trade diversification and for creating added value in the marketing of nuts.

The global walnut market is estimated at approx. 2.5 billion dollars, and Moldova is an important player in international trade, exporting walnuts in the value of 100-130 million dollars annually.

The walnut sector place the Republic of Moldova among the main producing states in the world. The volume of world nut

production is over 2 million tons, and the trend is constantly increasing in line with the continuous increase in consumption.

Table 1. Analysis of the world production of the walnut crops. The dynamics of the production of the walnut crops worldwide, in terms of quantity (tons) and structural (%).

Specification	Years								Average per 2015-2017 / Average per 2012-2014, %	Average structure, %
	2012	2013	2014	Average per years 2012-2014	2015	2016	2017	Average per years 2015-2017		
China	720,000	780,000	900,000	800,000	1,000,000	1,060,000	1,000,000	1,020,000	127.5	48.4
United States	450,871	446,335	518,003	471,736	549,754	622,329	589,670	587,251	124.5	28.1
Chile	53,000	60,000	81,634	64,878	80,000	117,000	120,000	105,667	162.9	4.5
European Union	110,000	110,000	107,900	109,300	117,928	116,670	115,000	116,533	106.6	6.0
Ukraine	96,940	115,790	102,740	105,157	115,080	108,000	113,000	112,027	106.5	5.8
Turkey	85,000	75,000	40,000	66,667	60,000	63,000	58,000	60,333	90.5	3.4
India	36,000	43,000	35,000	38,000	33,000	32,000	35,000	33,333	87.7	1.9
Others	31,000	30,800	40,500	34,100	37,500	39,500	39,000	38,667	113.4	1.9
<b>Total</b>	<b>1,582,811</b>	<b>1,660,925</b>	<b>1,825,777</b>	<b>1,689,838</b>	<b>1,993,262</b>	<b>2,158,499</b>	<b>2,069,670</b>	<b>2,073,810</b>	<b>122.7</b>	<b>100.0</b>

Source: Foreign Agricultural Service/USDA.

The volume of production in the period 2015-2017 increased by 22.7% compared to the period of 2012-2014, which shows a rapid growth. In the structure of walnut production, worldwide, China is the country with the highest share - 48.4%, followed by the United States with 28.1%.

Other important countries in the field of walnut production are the European Union (6%), Ukraine (5.8%) and Chile (4.5%). The volume of world walnut consumption is over 2.06 million tons, and the trend is steadily increasing in consumption, as this product is accepted as a healthy and beneficial food.

Table 2. Progress of consumption of walnut production worldwide, tons

Specification	Years								Average per 2015-2017 / Average per 2012-2014, %	Average structure, %
	2012	2013	2014	Average per years 2012-2014	2015	2016	2017	Average per years 2015-2017		
China	812,200	854,300	956,400	874,300	1,075,200	1,089,600	1,050,000	1,071,600	122.6	52.3
European Union	230,200	262,100	278,500	256,933	310,228	355,670	360,000	341,966	133.1	16.1
Turkey	117,500	115,100	101,100	111,233	142,500	159,200	163,000	154,900	139.3	7.2
United States	154,266	154,922	140,532	149,907	134,543	190,778	150,451	158,591	105.8	8.3
India	24,900	26,400	32,700	28,000	43,400	46,200	54,000	47,867	171.0	2.0
Japan	27,700	29,000	38,000	31,567	40,400	46,000	50,000	45,467	144.0	2.1
Ukraine	38,940	40,590	43,140	40,890	39,380	51,600	38,100	43,027	105.2	2.3
South Korea	28,200	29,100	33,900	30,400	30,500	32,100	35,000	32,533	107.0	1.7
Saudi Arabia	8,100	17,100	14,300	13,167	15,100	32,600	30,000	25,900	196.7	1.1
Canada	20,700	22,200	17,900	20,267	24,000	25,300	26,500	25,267	124.7	1.2
Others	106,700	107,800	102,941	105,814	116,050	100,068	108,050	108,056	102.1	5.8
<b>Total</b>	<b>1,569,406</b>	<b>1,658,612</b>	<b>1,759,413</b>	<b>1,662,477</b>	<b>1,971,301</b>	<b>2,129,116</b>	<b>2,065,101</b>	<b>2,055,173</b>	<b>123.6</b>	<b>100.0</b>

Source: Foreign Agricultural Service/USDA.

In the structure of world walnut consumption, China is the country with the highest consumption - 52.3%, followed by the European Union with 16.1%. Other important countries in the consumption of walnuts are the United States of America (8.3%) and Turkey (7.2%).

The volume of world export during the period 2015-2017 increased by 31% compared to the period 2012-2014, indicating the increased

interest in this production. In the structure of the world walnut export the United States of America is the country with the largest export 62.6%, followed by Chile with 13.1%. Other important countries in the field of walnut export are Ukraine (10.6%) and Moldova (5%).

The volume of world walnut imports amounts to about 700 thousand tons, and the trend is growing at a rather rapid rate.

In the structure of the world walnut import, the European Union is with the highest weight - 33.5%, followed by China with 12.9%.

Table 3. Dynamics of world export of walnut production for 2012-2017 (tons)

Specification	Years								Average per 2015-2017 / Average per 2012-2014, %	Average structure, %
	2012	2013	2014	Average per years 2012-2014	2015	2016	2017	Average per years 2015-2017		
United States	310,329	313,471	364,101	329,300	445,781	460,101	475,000	460,294	139.8	62.6
Chile	50,500	57,400	76,800	61,567	78,500	115,000	118,000	103,833	168.7	13.1
Ukraine	58,000	75,200	59,600	64,267	75,800	56,100	75,000	68,967	107.3	10.6
Moldova	25,100	27,100	36,800	29,667	34,100	34,000	34,000	34,033	114.7	5.0
China	16,100	16,700	14,500	15,767	8,300	19,000	20,000	15,767	100.0	2.5
European Union	15,000	24,700	16,500	18,733	18,300	13,500	15,000	15,600	83.3	2.7
Turkey	9,600	12,000	8,000	9,867	6,500	7,600	8,000	7,367	74.7	1.4
Others	18,700	19,200	13,600	17,167	11,300	9,000	9,500	9,933	57.9	2.1
<b>Total</b>	<b>503,329</b>	<b>545,771</b>	<b>589,901</b>	<b>546,334</b>	<b>678,581</b>	<b>714,301</b>	<b>754,500</b>	<b>715,794</b>	<b>131.0</b>	<b>100.0</b>

Source: Foreign Agricultural Service/USDA

Table 4. Dynamics of the import of walnut production worldwide, tons

Specification	Years								Average per 2015-2017 / Average per 2012-2014, %	Average structure, %
	2012	2013	2014	Average per years 2012-2014	2015	2016	2017	Average per years 2015-2017		
European Union	140,200	171,800	187,100	166,367	215,600	252,500	260,000	242,700	145.9	33.5
Turkey	42,100	52,100	68,100	54,100	90,500	105,100	110,000	101,867	188.3	12.8
China	108,300	91,000	70,900	90,067	83,500	48,600	70,000	67,367	74.8	12.9
Japan	27,700	29,000	38,000	31,567	40,400	46,000	50,000	45,467	144.0	6.3
South Korea	28,200	29,100	33,900	30,400	30,500	32,100	35,000	32,533	107.0	5.2
India	200	600	10,400	3,733	14,300	23,200	30,000	22,500	602.7	2.2
Saudi Arabia	8,100	17,100	14,300	13,167	15,100	32,600	30,000	25,900	196.7	3.2
Canada	20,800	22,600	22,600	22,000	24,500	25,800	27,000	25,767	117.1	3.9
Iraq	11,200	13,700	11,900	12,267	19,500	19,100	20,000	19,533	159.2	2.6
United States	10,885	15,417	27,402	17,901	13,931	20,210	20,000	18,047	100.8	2.9
Israel	9,600	9,600	10,700	9,967	13,000	13,400	14,000	13,467	135.1	1.9
Australia	10,600	12,200	12,400	11,733	11,200	11,600	13,000	11,933	101.7	1.9
Mexico	7,400	6,300	9,600	7,767	13,800	9,200	10,000	11,000	141.6	1.5
Brazil	8,000	8,300	7,100	7,800	8,200	9,000	9,500	8,900	114.1	1.4
Taiwan	7,300	6,400	8,300	7,333	8,900	8,000	9,000	8,633	117.7	1.3
Others	51,000	49,100	38,500	46,200	39,800	25,925	29,550	31,758	68.7	6.4
<b>Total</b>	<b>491,585</b>	<b>534,317</b>	<b>571,202</b>	<b>532,368</b>	<b>642,731</b>	<b>682,335</b>	<b>737,050</b>	<b>687,372</b>	<b>129.1</b>	<b>100.0</b>

Source: Foreign Agricultural Service/USDA.

Other important countries in the import of walnuts are Turkey (12.8%) and Japan (6.3%). The volume of walnut imports during the period 2015-2017 increased by 29.1%, compared to the period 2012-2014.

Under the conditions of the market economy, agricultural entrepreneurs must analyze in detail the procedure of starting the business in order to determine correctly the way of implementing the business and the volume of investments.

For the players in the value chain of the walnut sector, it is important, if the selected technology allows ensuring **quality, productivity and competitive price**. Only

the quality and high productivity of the walnut crops at a surface unit will allow us to compete and enter the production in the strategic markets for marketing walnuts.

An important aspect when planting walnut orchards - we need to know the development of the walnut sector in the republic for the last years, and this dynamic analysis is presented in Table 5.

The analysis of the dynamics of the development of the walnut production sector in the Republic of Moldova allows us to state that in the last years, 2014-2018, the growth rates are fast, due to the fact that the area has doubled (yielding orchards has increased

considerably) and respectively the volume of production has increased by 73 %, which is motivated by the increased interest and existence of the marketplace (Table 6).

Table 5. Dynamics of the development of the walnut production sector in the Republic of Moldova, 2010-2018

Specification Indicators	MU	Years										Growth 2019/2010, %
		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
<b>Fruit orchards, nuts and fruit shrubs - total</b>												
Surface - total	mii ha	116.30	119.20	119.80	122.50	122.30	135.56	134.53	135.47	139.50	140.13	120.5
Surface yielding	mii ha	94.20	94.20	95.00	90.20	89.90	110.36	110.12	113.00	114.70	114.21	121.2
<b>Production volume</b>	<b>mii tone</b>	<b>322.34</b>	<b>379.10</b>	<b>380.40</b>	<b>419.50</b>	<b>497.30</b>	<b>485.48</b>	<b>595.69</b>	<b>667.20</b>	<b>850.20</b>	<b>805.87</b>	<b>250.0</b>
Average harvest	t/ha	3.42	4.02	4.00	4.65	5.53	4.40	5.41	5.72	7.41	7.06	206.2
<b>Nut crops</b>												
Surface - total	mii ha	9.40	11.30	12.30	14.00	24.20	25.22	27.19	29.00	30.80	31.20	331.9
Surface yielding	mii ha	4.10	4.60	5.00	6.10	14.30	15.01	15.76	17.70	18.90	19.50	475.6
<b>Production volume</b>	<b>mii tone</b>	<b>11.58</b>	<b>14.00</b>	<b>9.10</b>	<b>12.50</b>	<b>13.10</b>	<b>11.04</b>	<b>13.83</b>	<b>18.50</b>	<b>20.20</b>	<b>20.00</b>	<b>172.7</b>
Average harvest	t/ha	2.79	2.99	1.77	2.06	0.88	0.70	0.84	0.94	0.96	1.03	36.8

Source: National Bureau of Statistics.

Table 6. Dynamics of planting new surfaces with walnuts in the Republic of Moldova, 2013-2019, (ha)

Years	Walnuts	Hazelnut	Almond	Total	Structure, %
2013	530.9	-	42.5	573.3	7.8
2014	1,042.0	85.7	8.0	1,135.7	15.4
2015	940.0	75.0	24.0	1,039.0	14.1
2016	1,193.0	104.0	17.0	1,314.0	17.8
2017	689.0	200.0	36.0	925.0	12.5
2018	705.5	144.0	31.5	880.9	11.9
2019	1,148.0	331.8	32.3	1,512.1	20.5
<b>Total, ha</b>	<b>6,248.3</b>	<b>940.5</b>	<b>191.2</b>	<b>7,380.0</b>	<b>100.0</b>
<b>Structure, %</b>	<b>84.7</b>	<b>12.7</b>	<b>2.6</b>	<b>100.0</b>	

Source: Agency for Intervention and Payments for Agriculture.

On average, annually, over 700-1,000 hectares of nuts are planted in the Republic of Moldova (the largest areas of orchards are planted with walnuts crops), which is suitable for the sustainable development of the sector and to satisfy the international demand, which is always growing.

**Important** for entrepreneurs who intend to plant nut orchards, it is that they have to find clear answers to the following questions (nobody can offer practical solutions, and to wait when the orchards will come into fruition - the period is extremely high and the investments are the same):

- (1)What is the correct and efficient planting scheme for different areas and different kinds of walnuts;
- (2)What is the need for pollination in orchards and how many percentages (to be compatible and to coincide in time);
- (3)Irrigation is required or not, as it is an important factor in ensuring the expected harvest;
- (4)What are the risks of frosts in winter and loss of harvest caused by late spring frosts;

(5)How can we ensure quality when growing walnuts, when we have rains that affect the quality and color of the kernel in autumn.

Sectoral recommendations for the sustainable development of the walnut sector in the Republic of Moldova:

- (a)Selection and experimental establishment of pollinators for basic varieties in commercial orchards (pollinator occupying no more than 5% of trees) are indispensable.
- (b)In the genetic improvement programs, as well as the temporary introduction and testing of valuable varieties from other cultivation areas, similar to the agro climatic ones in our country, genotypes with a long biological resting period, overlapping flowering periods with the local assortment are recommended, a high potential for fruiting both from the terminal and lateral buds, especially from the type of protandric flowering.
- (c)Given the local traditions of domestic spread and cultivation, etc., the walnut, with the presence of a large biodiversity (based on the secular propagation by seeds), remains an important crop, from a strategic point of view, for ensuring the organic production system.

Every year, in the Republic of Moldova, 3-4 thousand tons of walnuts are imported, that is 11.4% of the total quantity of imported fruits. These are subsequently shelled and sold on

the domestic market or redirected for export. Walnuts imported from France are peeled in Moldova, because labor is much cheaper and then exported to France unpeeled.

Table 7. Trade balance in the walnut trade of the Republic of Moldova (years 2005-2018, USD)

Specification	Years			Structure, % (average in 2005-2015)	Years			Structure, % (average in 2016-2018)	Deviations, % (average in 2016-2018/ average in 2005-2015)
	2005	2010	2015		2016	2017	2018		
<b>Import of walnut production</b>									
Fruits and nuts	17,686,868	58,020,725	74,601,482	56.1	47,390,259	54,258,784	69,328,265	51.6	113.8
walnuts	4,799,232	6,446,764	14,102,841	9.5	10,717,628	13,541,430	20,417,092	13.5	176.2
<b>Total</b>	<b>40,005,894</b>	<b>110,918,081</b>	<b>116,952,913</b>	<b>100.0</b>	<b>94,278,996</b>	<b>108,795,637</b>	<b>127,985,782</b>	<b>100.0</b>	<b>123.6</b>
<b>Export of walnut production</b>									
Fruits and nuts	60,977,459	167,624,748	194,658,725	71.2	155,823,843	221,584,638	196,429,637	76.6	135.6
walnuts	30,740,819	59,835,863	101,078,273	32.2	85,462,964	98,640,218	96,329,091	37.4	146.3
<b>Total</b>	<b>112,308,102</b>	<b>228,666,507</b>	<b>253,724,834</b>	<b>100.0</b>	<b>205,448,220</b>	<b>300,301,020</b>	<b>243,801,425</b>	<b>100.0</b>	<b>126.0</b>
<b>Trade balance walnut production (export-import difference)</b>									
Fruits and nuts	43,290,591	109,604,023	120,057,243	83.5	108,433,584	167,325,854	127,101,372	96.3	147.6
walnuts	25,941,587	53,389,099	86,975,432	50.9	74,745,336	85,098,788	75,911,999	56.3	141.8
<b>Total</b>	<b>72,302,208</b>	<b>117,748,426</b>	<b>136,771,921</b>	<b>100.0</b>	<b>111,169,224</b>	<b>191,505,383</b>	<b>115,815,643</b>	<b>100.0</b>	<b>128.0</b>

Source: National Bureau of Statistics.

The evolution of the volume of the import-export of the walnut production of the

Republic of Moldova, in quantitative aspect, is presented in Table 8.

Table 8. Dynamics of the import-export of the walnut production of the Republic of Moldova, (years 2005-2018, kg)

Specification	Years			Average per 2005-2015	Years			Average per 2016-2018	Deviations, % (average in 2016-2018 / average in 2005-2015)
	2005	2010	2015		2016	2017	2018		
<b>Import</b>									
Fruits and nuts									
walnuts	5,373,848	3,974,008	4,606,879	4,651,578	4,692,842	5,058,885	6,707,482	5,486,403	117.9
<b>Export</b>									
Fruits and nuts									
walnuts	10,486,203	9,822,015	15,104,114	11,804,111	15,796,558	15,265,929	14,263,359	15,108,615	128.0

Source: National Bureau of Statistics.

So, we noticed, that during the period 2016-2018 as compared to the period 2005-2015, the import of walnuts, in quantitative expression, increased by 17.9%, and the export of walnuts - by 28%. The predominance of the export, on the import of walnuts, is an appreciable thing for our country.

The main countries where walnuts are exported from the Republic of Moldova are EU countries (France, Germany, Poland, Romania), Turkey. These markets require both shell walnuts and kernels.

Export markets for horticultural production require qualitative diversification (including in the case of walnut production). The traders continue to explore traditional markets without making any effort to diversify and increase the value of exports to new, more advantageous and strategic markets.

The analysis of the export shows us a diversified market for walnuts (dominated by the European Union, but without great difficulties to be oriented to other markets, because there is demand and the consumption is developing).

Table 9. Structure of the export of walnuts of the Republic of Moldova on the top markets, period 2017-2018

Product specification	Year	Top market 1	Top market 2	Top market 3	Top market 4	Top market 5	Observation
Walnuts	2017	France (61.9%)	Germany (27%)	Turkey (7.8%)	Romania (2.3%)	Poland (1%)	Diversified
	2018	France (26%)	Germany (20.9%)	Austria (11.7%)	Holland (10.9%)	Other countries (30.6%)	Diversified

Source: National Bureau of Statistics.

The policy of the purchase prices of the walnut production is influenced by the intermediaries and exporters, who actually export in a relatively small number and can influence the collection prices - acquisition,

which was in average 50 lei / kg of peeled walnuts. (walnut kernel) for 2018, and in 2019 the purchase price adjusted and makes 60-95 lei / kg depending on the quality of the kernel.

Table 10. Size and dynamics of the export price of walnuts from the Republic of Moldova and the import price for the countries where we export walnuts

Specification	Year		
	2016	2017	2018
<b>Analysis of the export of walnuts from the Republic of Moldova</b>			
Quantity of walnuts exported, t	15,797	15,266	14,400
Value of exports, USD	85,463	98,640	95,631
<b>Average export price, USD/kg</b>	<b>5.41</b>	<b>6.46</b>	<b>6.64</b>
<b>Analysis of Germany's import of walnuts (country with high import of walnuts from the Republic of Moldova)</b>			
Germany - imported quantity, t	232,964	268,878	272,430
Germany - value of the import, thousands of USD	1,954,834	2,010,571	2,115,021
<b>Germany - average import price, USD/kg</b>	<b>8.39</b>	<b>7.48</b>	<b>7.76</b>
<b>Analysis of the import of walnuts of France (country with high import of walnuts from Moldova)</b>			
France - imported quantity, t	92,970	99,841	98,248
France - value of the import, thousands of USD	756,565	733,968	735,890
<b>France - average import price, USD/kg</b>	<b>8.14</b>	<b>7.35</b>	<b>7.49</b>

Source: National Bureau of Statistics.

In the following table, you may find the analysis of the value chain for domestic walnuts for different clusters, depending on

the current sales on markets and the potential for future export.

Table 11. Analysis of value chain and value added for walnuts in the Republic of Moldova, 2018

Specification	Value chain when marketing walnuts on regional markets					
	East		EU		Moldova	
	Euro/kg	Share, %	Euro/kg	Share, %	Euro/kg	Share, %
<b>Final supermarket price</b>	<b>13.351</b>	<b>100.0</b>	<b>13.968</b>	<b>100.0</b>	<b>8.969</b>	<b>100.0</b>
Commercial margin supermarket	6.215	46.6	6.574	47.1	3.567	39.8
Cost and export logistics	0.921	6.9	0.819	5.9		
<b>Final export price or local market entry</b>	<b>5.294</b>	<b>39.7</b>	<b>5.755</b>	<b>41.2</b>	<b>5.351</b>	<b>59.7</b>
Commercial margin intermediaries	2.730	20.4	3.191	22.8	2.786	31.1
<b>VAT refund</b>	<b>0.424</b>		<b>0.460</b>			
Price of walnuts to the producer with VAT	2.564	19.2	2.564	18.4	2.564	28.6

Source: Analysis developed by the group of authors.

The marketing of walnuts is much more advantageous and this is explained by the fact of the increased interest on international markets and the deficit of walnut kernel. In the case of walnuts, the traditional export market is the EU, but it is also a stable export to the East.

The EU market will remain a core customer and will continue to be, but other new markets

in Asia should not be neglected, for trade diversification and for creating added value in the marketing of walnuts.

The forecast for the development of the walnut sector of the Republic of Moldova indicates a positive trend of increasing the volume of the production of walnuts, given the modernization / application of modern technologies of production and the increase of

the productivity of the sector at a surface unit. *The nut crop* is experiencing a rapid development, stemming from the trends on the world market, and the surface of the plantations of nut crops is growing rapidly and by 2026 will make approx. 38.5 thousand hectares (including 26.27 ha fruiting, or 34.7% higher than in 2019). The production

of walnuts faces a higher demand and the annual consumption is increasing. In the period 2014-2018, in the Republic of Moldova, considerable areas of nut crops were planted (annually about one thousand hectares), which will be conditioning the growth of walnut production by 82.3% (16.5 thousand tons) by 2026, compared to 2019.

Table 12. Forecast for the development of the walnut sector in the Republic of Moldova, period 2020-2026

Specification	Years						
	2020	2021	2022	2023	2024	2025	2026
Total surface with nut crops, thousands ha	32.15	33.14	34.15	35.20	36.28	37.39	38.54
Surface on fruiting, thousands ha	20.05	21.17	22.19	23.48	24.39	25.31	26.27
The global crop of nuts, thousands tons	22.76	24.90	26.95	29.60	31.71	34.06	36.46
Productivity of nut crops, tons/ha	1.14	1.18	1.21	1.26	1.30	1.35	1.39
Surface harvested mature plantations, thousands t	18.61	18.59	18.57	18.55	18.53	18.51	18.49
Average harvest of mature plantations, t/ha	1.12	1.15	1.18	1.21	1.24	1.27	1.30
Production volume in orchards, thousands t	20.88	21.42	21.88	22.44	22.93	23.52	24.02
Surface harvested new plantations, thousands t	1.44	2.58	3.62	4.93	5.86	6.80	7.78
The average crop of new plantations, t/ha	1.30	1.35	1.40	1.45	1.50	1.55	1.60
Production volume in new orchards, thousands t	1.88	3.48	5.07	7.15	8.79	10.54	12.44
Establishment of new orchards, thousands ha	1.00	1.04	1.07	1.10	1.13	1.17	1.20
Deforestation of old orchards, thousands of hectares	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Balance of planting orchards	0.98	1.02	1.05	1.08	1.11	1.15	1.18

Source: Forecast developed by the group of authors [1, 2, 3].

At the same time, the hazelnut is requested on the markets, and the Republic of Moldova has the necessary conditions for its cultivation and it is necessary to diversify the production in case of ensuring all the factors necessary for cultivation. The forecast of the investments necessary for the modernization of the infrastructure of the nut sector for the years 2020-2026 foresees an estimated need of

2,330.4 million lei, of which 913.5 million lei will make the subsidies to compensate a part of the investments. The harmonious development of the nut sector, in the Republic of Moldova, for the period 2020-2026 also refers to the modernization of the production technologies and the progression of the applied researches in order to increase the efficiency of the cultivation of the nut crops.

Table 13. Forecast of the development of the walnut sector through investments, period 2020-2026

Specification	Years							Total	Average per year
	2020	2021	2022	2023	2024	2025	2026		
Establishment of walnuts plantations, ha	1,004.3	1,035.2	1,066.9	1,099.5	1,133.0	1,167.5	1,203.0	7,709.4	1,101.35
Need for investments in multi-annual plantations, mln. MDL	135.3	139.4	143.7	148.1	152.6	157.3	162.0	1,038.4	148.34
Subsidizing investments in multi-annual plantations, mln. MDL	30.77	31.72	32.69	33.69	34.72	35.77	36.86	236.22	33.75
Capacity needed to modernize, thousands tons	0.92	0.95	0.97	1.00	1.03	1.06	1.09	7.01	1.00
Capacity needed to modernize, mln. MDL	4.49	4.61	4.74	4.87	5.01	5.15	5.30	34.17	4.88
Subsidizing investments in packinghouses, mln. MDL	1.12	1.15	1.18	1.22	1.25	1.29	1.33	8.54	1.22
<b>Total value of investments in the walnut subsector, mln. MDL</b>	<b>139.8</b>	<b>144.0</b>	<b>148.4</b>	<b>153.0</b>	<b>157.6</b>	<b>162.4</b>	<b>167.3</b>	<b>1,072.5</b>	<b>153.2</b>
<b>Subsidizing investments in the walnut subsector, mln. MDL</b>	<b>31.9</b>	<b>32.9</b>	<b>33.9</b>	<b>34.9</b>	<b>36.0</b>	<b>37.1</b>	<b>38.2</b>	<b>244.8</b>	<b>35.0</b>

Source: Forecast developed by the group of authors [4].

For the sustainable development of the walnut sector for the years 2020-2026, an estimated 1.072.5 million lei are needed, of which 244.8 million lei will make subsidies to compensate a part of the investments.

The impact of the sector development shows a high economic effect, because at a leu invested in the walnut sector of the republic, it is possible to get an additional 15.26 lei, and

in the case of subsidies - 66.89 lei can be generated additionally.

Practical recommendations for improving the development of the walnut sector of the Republic of Moldova:

(1)The integrated business with nuts demonstrates the performance of the producers only through professional association and commercial cooperation;

(2)The state, together with the donors, intermediaries and producers of nut crops, will develop and implement a program of measures designed to create favorable conditions for cooperatives in marketing groups, which includes some fiscal facilities, an institutional and economic support framework. especially in the first 5-10 years of activity;

(3)The association of farmers in professional associations must provide an adequate information circuit to the producers and provide operational information on the real situation in the area and regional markets;

(4)Quality standards become a critical necessity in the context of general traceability requirements. Organic certification offers opportunities for marketing at favorable prices

and provides opportunities for marketing on the European market;

(5)For the efficient and sustainable development of the walnut sector in the Republic of Moldova it is necessary to introduce intensive technologies for their cultivation;

(6)Walnuts producers recognize the importance of standards and intend to implement HACCP and GlobalGAP in the near future. According to them, quality standards are becoming a critical necessity in the context of general traceability requirements, which concern not only the demanding EU markets, but also the top segment of the CIS markets. The state must include these activities in national support and grant programs.

Table 14. Estimation of the impact for the walnut crops in the Republic of Moldova, period 2020-2026

Specification	Years							Total	Average per year
	2020	2021	2022	2023	2024	2025	2026		
Payroll fund for manual operations for walnut production, mln. MDL	520.6	536.5	555.7	572.7	593.2	611.4	630.2	4,020	574.3
Gross profit from walnut marketing - total, mln. MDL	1,854	1,981	2,158	2,331	2,515	2,668	2,863	16,371	2,339
trade on local market	263.7	268.9	275.7	281.2	288.2	294.0	299.9	1,971	281.6
trade on export	1,432.5	1,550.3	1,715.8	1,878.2	2,050.0	2,191.1	2,375.2	13,193	1,884.7
processing	157.4	162.2	167.0	172.0	177.2	182.5	188.0	1,206	172.3
Value of walnut exports, mln. USD	123.8	136.8	150.3	167.5	183.1	200.5	219.0	1,177	168.2
Profit generated from an investment leu	13.26	13.76	14.54	15.24	15.96	16.43	17.11	15.26	15.26
Profit generated from a leu of subsidies, lei	58.12	60.28	63.72	66.79	69.93	71.98	74.97	66.89	66.89

Source: Forecast developed by the group of authors [4].

## CONCLUSIONS

The nut cultivation sector in the Republic of Moldova has been developing dynamically over the last ten years, and this trend allows one to conclude that the future of this sector is promising.

The development of value chains for the walnut sector is important through only with the condition of continuous improvement of the technology, post-harvest infrastructure and economic association / cooperation of the producer's nuts for creating benefit to the sector's production and ensuring the sustainable development of the walnut business.

## REFERENCES

[1]Zbanca, A., 2014, Developing of generic budgets for businesses in high-value farming. Informative guide,

Agricultural Competitiveness and Enterprise Development Project (ACED), Contract: AID-117-C-11-00001, Chisinau 2013-2014.

[2]Zbanca, A., Stratan, A., Morei, V., Litvin, A., 2009, Guide on economic argumentation of the agricultural activities of the Republic of Moldova (vegetal sector), Bons Offices Publishing House, Chisinau, 216 pag.

[3]Zbanca, A., Panuta, S., Fala, Iu., Stratan, A., Morei, V., Litvin, A., 2017, Budgeting of activities in the vegetal sector of the Republic of Moldova, Bons Offices Publishing House, Chisinau, 250 pag.

[4]Zbanca, A., Crigan, A., Pesteanu, A., Nicoleaescu, Gh., National Programme for Horticulture Development in Republic of Moldova for 2020-2026 years, Ministry of Agriculture, Regional Development and Environment.