Directions for Stimulating the Development of the Walnut Production System

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Abstract: In the article, analyzes were made on the prospective development of the walnut industry in Uzbekistan. It is advisable to implement the following arrangements for the sustainable development of the walnut industry: -strengthening the use of intensive technologies in the production of walnuts in the republic and increasing its efficiency; -establishment of a quality seedling breeding system and further development of high-yielding varieties; -establishment of the cultivation of walnut varieties suitable for the climate of the regions and development of the system of providing qualified personnel and retraining; -introduction of intensive and digital technologies in walnut production and economic efficiency improvement; -to ensure quality delivery of products to final consumers by gradually eliminating problems in walnut production and sale and storage system.

1 INTRODUCTION

In the context of global climate change, the world's leading research centers and institutions are conducting few scientific research on the production and processing of walnuts. In particular, such areas of research as the selection and breeding of high-yielding varieties of walnuts following the natural and climatic conditions of the regions of Uzbekistan, the introduction of modern marketing methods into the sales system of walnuts and walnut products, the development of innovative activities in the field, improving the efficiency of research, obtaining high-quality products from seedlings of breeding varieties grown industrially, the organization of intensive production of walnuts and the creation of sites for technical and technological parameters of production (Ministry of Health of Uzbekistan, 2020).

The climatic conditions of the mountainous regions of Uzbekistan are relatively favorable for the growth and high yield of seedlings of trees such as walnuts, almonds, and pistachios. Therefore, large-scale structural reforms have been implemented aimed at the sustainable development of the network of walnut production and processing of this product. However in the development of the walnut industry, systemic effective market mechanisms have not been created, and the insufficiency of the scientific approach leads to the fact that the available opportunities of the industry are not fully used (Sohda, T., et al. 1982).

2 LITERATURE REVIEW

The details, economic effectiveness, and organizational and economic features of walnut production in Uzbekistan have not been thoroughly examined as a research topic, despite the fact that numerous studies have been conducted in this area. A relatively recent development, the measures of the economic efficiency of walnut production under Uzbekistani conditions have only been largely examined in the composition of many fruiting studies. Additionally, the demand for walnuts and walnut-derived goods is rising during the intensive development phase, when new organizational and economic processes are implemented in the context of sustainable agricultural development (Yoshioka, T., et al. 1989).

In addition, the expansion of the market of fruit and vegetable products in the domestic and foreign markets is putting fundamentally new tasks in the field of walnuts to further develop the system of production, sale, and processing of walnuts and other

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Table 1: The volume of walnut production in the regions of Uzbekistan (tons)

Regions	2017 y.	2018 y.	2019 y.	2020 y.	2021 y.	2021 compared to 2017, %
Uzbekistan	65463	59758	67733	79,1	79300	121,1
Republic of Karakalpakstan	10	13	16	13	24	240,0
Andijan	12164	21146	22185	28392	26232	215,7
Bukhara	454	1909	2483	2545	2221	489,2
Jizzakh	4436	6861	7288	7319	8644	194,9
Kashkadarya	3852	2306	1479	1853	1185	30,8
Navoi	1265	2175	3358	2720	2560	202,4
Namangan	6311	4847	5133	6802	6836	108,3
Samarkand	18650	6903	11757	15670	15350	82,3
Surkhandarya	12537	6605	5289	5823	5797	46,2
Syr Darya	1148	794	1226	800	899	78,3
Tashkent	3338	3910	5398	6377	6529	195,6
Fergana	1260	2284	2121	2940	3023	239,9
Khorezm	38	5	-	-	-	-

walnut products. In this regard, the development of scientific recommendations and practical proposals aimed at improving the organizational and economic basis of walnut production is of urgent importance (Cantello, B. C. C., et al. 1994; Oi, S., et al. 2016; Kawale, L., et al. 2020; Zheng, Y., et al. 2023; Hernandez, H., & Shivraj, L. 2020).

3 ANALYSIS AND RESULTS

The walnut market is a relatively new market for Uzbekistan, which is now in its formative stages. The importance of this market is increasing for the following reasons. First of all, this is a resource base for confectionery and bakery products. For companies in this area, it is much cheaper to buy walnuts not in the form of raw materials, but in the form prepared according to international standards (roasted, ground, and other). Secondly, it is important the sell of packaged walnuts in the retail system. Marketing research conducted by the authors showed that the population's demand for walnuts is growing rapidly. Thirdly, the export of these roasted and ground walnuts is important. From this, the study analyzed the current situation, based on proposals for the organization of marketing services in the system and the organization of an effective sales system in the domestic and foreign markets in case of problems.

As a result of comprehensive reforms aimed at stimulating and further improving the efficiency of use of fallow lands in the foothill regions of Uzbekistan, increasing competitive volumes of walnut production in the domestic and foreign markets, creating modern walnut plantations through the wide involvement of foreign investments, as well as the widespread introduction of scientifically based methods and intensive technologies for growing walnuts, walnut production volumes in the regions are increasing (Table 1).

The analysis indicates that if the gross harvest of walnuts in Uzbekistan increased by 21.1 percent in 2021 compared to 2017, this figure increased by 2.4 times in the Republic of Karakalpakstan, 2.1 times in Andijan, 4 times in Bukhara, 9 times in Jizzakh, 1.94 times in Navoi, 1.9 times in Tashkent, 1.8 times in Namangan, and 2.39 times in Fergana. Conversely, the amount of walnuts produced fell by 30.8% in the Kashkadarya region, 82.3% in Samarkand, and 46.2% in Surkhandarya.

The destruction of walnut plantations in mountain and sub-mountain regions, the rise of different illnesses, issues with variety selection, and the region's water shortage in 2021 are the primary causes of this.

If we compare the Andijan region's and the Republic's walnut production indicators, we can see that the Andijan region grew 7022 tons of walnuts in 2021, 12.1 times less than the Republican indicator. However, this indicator has increased 1.6% since 2017. Every year, there is an upward tendency in the amount of walnuts produced per person. On the other hand, if the average yearly consumption of walnuts per person is 8 kg according to medical norms, then Uzbekistan's consumption is 2.1 times lower in 2021, or 4.5 times lower.

Throughout the study, the opinions of the participants were examined using a questionnaire in order to determine and assess the issues pertaining to walnuts in the present day and to formulate recommendations for their eradication (Fig. 1).

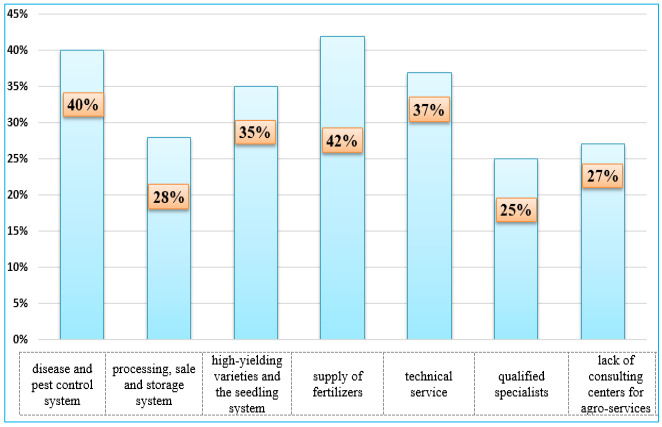

Figure 1: Problems related to walnut production (share in % to total respondents).

According to the results of the survey, 40% of the respondents said that the disease and pest control system has not been established enough, 28% in the processing, sale and storage system, 35% in the cultivation of high-yielding varieties and the development of the seedling system, 42% in the supply of fertilizers does not meet the demand, 37% the problem of technical service, 25 percent lack of qualified specialists in the field and 27 percent the lack of consulting centers for the providing of agro-services identified as the main problems and shortcomings related walnut today.

It is known that several factors directly affect the formation of walnut prices in the markets. In particular, the number of walnut producers, the volume of production, their location, the form of property, as well as the income of the population, fluctuations in the price of walnuts, changes in supply and demand, and market conjuncture are factors that have a significant influence on the development of this industry.

Currently, there are no specialized institutions in Uzbekistan that carry out analytical and research work on the solutions of marketing problems of walnut producers. In practice, the companies themselves analyze the ways of organizing their activities in the markets using the simplest marketing methods and form conclusions. Although the functions of government agencies include the task of conducting marketing research, in practice they do not pay enough attention to this issue.

The analysis of the channels of sale of walnuts grown in Andijan region shows that most of the walnuts grown in total are sold in farmers' markets, supermarkets or stores, various fairs, mobile shops, and directly in farm fields.

The main problem is the presence of "informal intermediaries" between producers and buyers in the formation of walnut prices in the markets of the researched areas, which creates the base for the price of walnuts to increase by 25-30 percent on average at each stage.

In general, the use of modern marketing methods in the system of selling walnuts and walnut products, product processing, and delivery of quality and organic products to the consumer are the main conditions for today's sustainable development.

Even when the minimum level of yield and product price are set at 25–30% below retail prices, the income from production per hectare is 42,1–51,4 million UZS in the traditional way and 86,9–103,5 million UZS in the intensive way, according to a comparative analysis of the organization of walnut plantations on one hectare in various ways, maintenance costs and income, and efficiency indicators. Production profitability was 150.4 and 329.5 percent, respectively (Table 2).

As a result, it is evident that the intensive strategy results in prices that are eight to nine times more than those of starting a one-hectare walnut plantation. Generally speaking, the following factors demonstrate the effectiveness of intense walnut production:

- a 3–4 times increase in the number of seedlings planted intensively on one hectare of land; - a high degree of labor automation in product production; - a high degree of water and mineral fertilizer efficiency through intensive drip irrigation; - ease of control and high efficiency against diseases and pests; - the high likelihood of rapid fruiting of intensively established plantations and the application of suitable agrotechnical measures;

- the ease of harvesting the product and performing other agrotechnical tasks; - the introduction of highly resource-saving technologies, etc., will fully offset the costs associated with the establishment of a plantation in an intensive manner within three to four years after

Table 2: The economic efficiency of growing walnuts in different ways on an acre of land (in 2021 prices)

Indicators		unit	traditional way, by varieties		intensive way, by varieties	
			Ideal	Chandler	Ideal	Chandler
Costs of establishing a walnut plantation on 1 hectare of land		thousands UZS	13164	14926	133657	136755
Annual maintenance costs of 1 hectare of walnut plantation (when fully harvested)	Total	thousands UZS	14577	15491	19446	22263
	Salary		5559	5915	7414	7919
	Material and other costs		9018	9576	12032	14344
Periods of starts the main harvest of walnut plantations	5 year	c/ha	5,3	8,4	10,5	16,4
	7 year	c/ha	10,1	15,3	22,2	32,1
	10-15 year	c/ha	25	31,2	54,4	65,5
On average, 1 hectare of walnut plantation (when in full harvest)	income	thousands UZS	36500	45552	79424	95630
	profit	thousands UZS	21923	30061	59978	73367
Rentability		%	150,4	194,1	308,4	329,5

the plantation is fully harvested. The features of market interactions are not widely incorporated, according to a review of the organizational processes that currently govern the growth of the walnut business. We propose the following economic stimulation avenues to boost the walnut industry's efficiency (Table 3).

By analyzing the levels of interaction of the factors that directly affect walnut production in the sub-sectors of agriculture, in particular, walnut production, by evaluating the impact of factors on the volume of walnut production in the regions, and based on this, it is possible to draw a conclusion on the main directions and forecast parameters of the development of walnut production.

Using the "Data analysis" package in Microsoft Excel, a model of the influence of such factors as the area planted with walnuts, the amount of walnut processing, the total amount of fertilizers used, the average annual temperature, and the average annual precipitation on the volume of walnut yield was developed (Table 4).

From the results of the model, it was found that the factors reflected in the model have a strong relationship with the gross yield of walnuts. A multifactor regression model equation was created:

$$Y = -3297,8 + 3,52*\beta_1 + 2,496*\beta_2 + 1,262*\beta_3 + 13,081*\beta_4 + 8,631*\beta_5 \quad (1)$$

Where,

Y– gross yield of walnuts;
β_1 – field planted with walnuts;
β_2 – volume of walnut processing;
β_3 – total spent fertilizer;
β_4 – annual average temperature;
β_5 – average annual precipitation.

Now, if we analyze the indicators of walnut production in Andijan region by farm categories, in 2022, the share of dekhkan farms (small households) is 4500 tons (59.7%), the share of farms is 2845 tons (37.7%), and the share of other producers is 197 tons (2.6%) (Figures 4, 5).

The forecast of changes in the volume of production of peanuts was calculated using a linear function in the cross-section of farmers and dekhkan farms and other producers. According to this, by 2030, 18,651.5 tons of walnuts will be produced in the region. These products in the section of categories, constitutes in particular, in dekhkan farms 13176.1 tons (70.7%), in farms 5027.8 tons (26.9%) and in other producers 447.6 tons (2.4%)

In general, evaluation of the impact levels and change trends of the main factors affecting the volume of walnut production in the walnut industry using multi-factor regression, linear trend models over time, drawing conclusions, preparing proposals based on forecast indicators will lead to a positive result..

Table 3: Directions of state stimulation of the development of the intensive walnut production system

Directions of stimulation	Arrangements	Financial source
State financial support to suppliers of quality seedlings	- creation of a system of cultivation of exportable walnut seedlings and its certification; - introducing the practice of subsidizing entrepreneurs who create plantations based on the planting of fertile walnut seedlings. In this case, it is recommended to introduce a mechanism to cover 15% of costs of seedling damage from the second year of planting each crop.	Commercial banks, private investors, various funds
Providing services to entrepreneurs who organize walnut farms and creating an information supply system.	- creation and full operation of a database, platform, which contains information on producers and exporters of walnuts and walnut products; - organization of consulting services that conduct marketing research on the study of foreign markets and publish their materials on special websites and forums.	Ministry of Investments and Foreign Trade, Loans and Grants of Foreign Financial Institutions
Training, upgrading and retraining of personnel for the walnut industry	- Ensuring the visit of agronomists, marketers, farmers from advanced countries in walnut production and organizing training sessions; - carrying out internships of personnel engaged in walnut growing, engaged in the science of the sphere in foreign countries with developed walnut growing industries.	International grants, funds from business entities, funds from state funds
Development of cooperative relations in the walnut industry	- development of product growing and processing cooperatives with the participation of farmers and households engaged in walnut production; - promotion of exports based on the introduction of export subsidies for walnut exporters in the first 2 years of their activity. In this case, it should be determined that 5% of the export earnings of the subsidy recipients should be directed to the development of export logistics.	Funds from the state budget, entrepreneurs from their own funds

Table 4: The model of relationship between walnut gross yield and selected factors (in the case of Andijan region)

Dependent outcome variable and independent variables (factors)	Coefficient	t- statistics	Probability
β_1 – field planted with walnuts, ha	3,520	4,252	0,0053
β_2 – volume of walnut processing, tons	2,496	2,463	0,0489
β_3 – total spent fertilizer, tons	1,262	2,078	0,0829
β_4 – annual average temperature, °C	13,081	0,043	0,9668
β_5 – average annual precipitation, mm	8,6307	2,929	0,0263
_cons	-3297,8	-0,823	0,442
R^2- coefficient of determination	0,9881		
Corrected R-squared	0,9782		
Standard error of the regression	352,86		
Probability (F - statistics)	0,0000108		

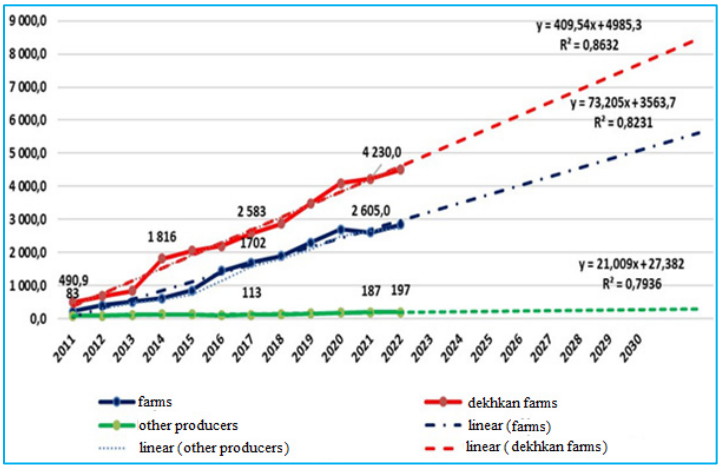

Figure 4: Forecast of walnut production in Andijan region by producer groups until 2030.

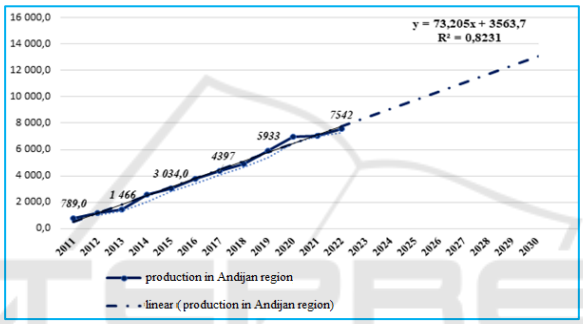

Figure 5: Forecast of walnut production in Andijan region until 2030.

4 CONCLUSION

In conclusion, many factors influence the change in the volume of walnut production in the Andijan region. Taking into account the effects and direct relationship of several factors such as soil and climate conditions of the Andijan region, average annual precipitation, average annual temperature, selection of high-yielding varieties of walnuts, the area planted with walnuts, the total amount of mineral fertilizers used, the volume of walnut processing. in this case, it will be possible to make a reasonable analysis of the change in the gross yield of walnuts and to determine the forecast values for the future.

It is advisable to implement the following arrangements for the sustainable development of the walnut industry: - strengthening the use of intensive technologies in the production of walnuts and increasing its efficiency; -establishment of a quality seedling breeding system and further development of high-yielding varieties; -establishment of the cultivation of walnut varieties suitable for the climate of the regions and development of the system of providing qualified personnel and retraining; - introduction of intensive and digital technologies in walnut production and economic efficiency improvement; -to ensure quality delivery of products to final consumers by gradually eliminating problems in walnut production and sale and storage system.

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