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REVIEW PAPER

Economic efficiency of the major crops in Azerbaijan

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ABSTRACT

The aim of the paper was to evaluate the economic efficiency of crop production in Azerbaijan. Twenty thousand data sets from the Farm Data Monitoring System (FDMS) for the period 2015-2019 are analyzed. Vegetable farms are smaller, but more intensive and efficient. Cereal production is less productive, and the income generated is low per farm and per ha. The relationships between yield and area per farm and irrigation as well as the relationship between profit per hectare and area per farm and irrigation are not confirmed by simple regression. Potential future applications of FDMS could include productivity, the impact of subsidies on business performance, farm competitiveness and resilience.

Key words: farm income, gross margin, farms, crop production, Azerbaijan

INTRODUCTION

The Azerbaijani economy is heavily dependent on the revenues from fossil oil and natural gas. Nevertheless, the Azerbaijani government is investing heavily to diversify the economy (Strategic Roadmap, 2016). This also includes attempts to develop competitive agriculture and vibrant rural areas. Food security is to be ensured by increasing domestic production and reducing dependence on imports of agricultural products and food (Strategic Roadmap, 2016).

Agriculture, fisheries and forestry contribute an average of 7.8% or 2,458 million manat to GDP in the period 2000-2020. GDP in agriculture is growing in absolute terms. In 2020, it reached 5,016 million manat. In relative terms, the share of agriculture in GDP is relatively stable at the level of 5.5% in the period 2010-2020 (AzStat, 2022).

The total agricultural area (UAA) in Azerbaijan is 4.7 million ha. Half of this is pastureland and around 2 million ha is arable land. The area under permanent crops reached 272 thousand ha in 2020, which corresponds to 5% of UAA. Cereals, especially wheat, dominate the area under cultivation. Vegetables and permanent crops are only represented by a small percentage. The area under potatoes, vegetables, watermelons, and melons as well as industrial crops has even declined recently (AzStat, 2022).

Government policy to support agriculture includes a number of elements, such as payments per hectare, payments per kg of produce, subsidies for inputs and tax exemptions (Huseyn, 2013). For 2021, farmers growing wheat in the country will receive a subsidy of 240 manat per hectare and farmers growing maize will receive a subsidy of 200 manat per hectare. It should be noted that 25% of this amount can be redeemed and the remaining amount can be used for the purchase of agricultural inputs, conducting agrochemical analysis of soils, purchase, and construction of modern irrigation systems (Ministry of Agriculture of the Republic of Azerbaijan- MoA, 2022).

The Azerbaijani agricultural sector is highly fragmented—that is, there are many small farms with small plots of land on average. Farms with more than 5 ha of agricultural land account for only 5% of all agricultural producers, but these farms use 48% of the total agricultural land. The number of smaller farms with 2 ha or less totals 900,000. The land used by these families is so small that production is largely for subsistence and only small surpluses are marketed (van Berkum, 2017). Davidova (2014) offers three paths for small farms: Disappearance through absorption into larger commercialized farms or abandonment of land, conversion of small farms to small commercial farms through greater market integration and continuation through diversification, off-farm wage labor, or 'forced' re-entry as subsequent generations of families have no other sources of income.

The analysis at farm level is based on regular and ad hoc surveys. The Farm Accountancy Data Network (FADN) monitors the income and business activities of farms. It is also an important source of information for understanding the impact of measures taken under the Common Agricultural Policy. The FADN is the only source of microeconomic data based on harmonized accounting principles (Očić et al., 2016). Some non-EU countries have set up a FADN (Norway and Switzerland) or a FADN-like system (e.g., the Azerbaijani FDMS).

The aim of this article is to assess the production and economic efficiency of the main arable crops (wheat, barley, maize, potatoes, tomatoes and perennial crops (apples and hazelnuts)) in Azerbaijan and compare them with existing databases in order to gain access to the economic results of the different farm types and the quality of the data collected.

MATERIAL AND METHODS

The Agricultural Research Center (ARC) under the MoA collects data from up to 4,000 farms in the FDMS every year. Universe/ population are farmers receiving subsidies (about 400,000 farmers). A sample of 4,000 farms therefore corresponds to around 1% of the population. The data is collected by 350 enumerators in the regions (employees of the regional offices of the MoA).

The questionnaire was designed by ARC staff. The questionnaire collects production data (area, yields, livestock, and livestock production) and socio-economic data. The data on crop production is suitable for analysis.

The data used in this work comprises around twenty thousand data records for the period 2015-2019. Data is available on the following variables: Farm identification number, utilized agricultural land, yield, irrigation use, total revenue (including different market channels, on-farm use and household use), total direct or variable costs (seeds, fertilizers, pesticides,

irrigation costs, insurance and machinery) and profit per hectare (difference between revenue and costs divided per hectare of farmed area).

Methodology applied in measuring farm business efficiency includes following indicators:

Revenues= ∑ (Sold quantity x price); (Farm used x price); (Household used x price); (Processed x price); AZN

Variable Costs= ∑ seed; fertilizers; plant protection materials, insurance, machinery and irrigation costs, AZN

Gross Margin= Revenues – Variable costs, AZN

Regression analysis is used to test relationships between yield (dependent variable) and area per farm and availability of irrigation (independent variables).

Monetary values are expressed in Azerbaijani manat (AZN). The average exchange rate AZN: EUR was 1.74:1.00 in the period 2015-2019 (EU Commission, InforEuro, 2023).

The State Statistics Committee of the Republic of Azerbaijan (AzStat) provides a large set of data on the agricultural sector. AzStat (2021) uses various production and business data from private agricultural enterprises as a secondary data source. There are about 250,000 larger farms with more than 2 ha of land. This group includes around 2,000 public and private agricultural enterprises, as well as private farms that are often registered as companies (van Berkum, 2017).

The literature on farm management and farm monitoring was analyzed together with the EU Farm Accountancy Data Network.

RESULTS AND DISCUSSION

Yield levels depend on technology and labor productivity as well as environmental conditions (soil quality, climatic conditions and water availability). In the case of Azerbaijan, the yield of the crops studied is low compared to modern production standards (Fig. 1). The average yield of wheat is 3 of barley 2 and of maize less than 5 t/ha. While maize yields are slowly increasing, wheat and barley yields are relatively stable over the years.

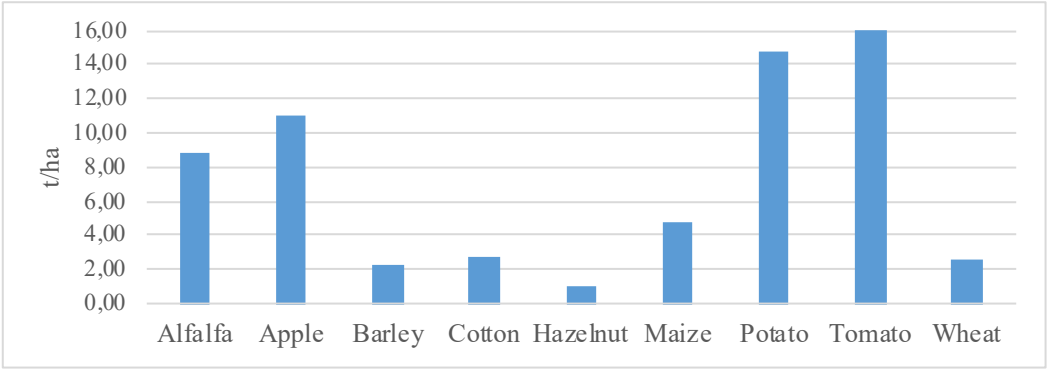

Figure 1. Average Yield of Selected Crops (average 2015-2019)
Source: FDMS

The available data are not sufficient to calculate productivity indicators, neither partial ones (like labor productivity) nor composite ones like total factor productivity. This makes it impossible for us to compare average yields with other countries and to discuss the factors that influence yield levels. As a benchmark, we compared the yields of the most important (in terms of share of land use) arable crops (Fig. 2) in AzStat and FDMS. The yields recorded in FDMS, and the official statistics are consistent.

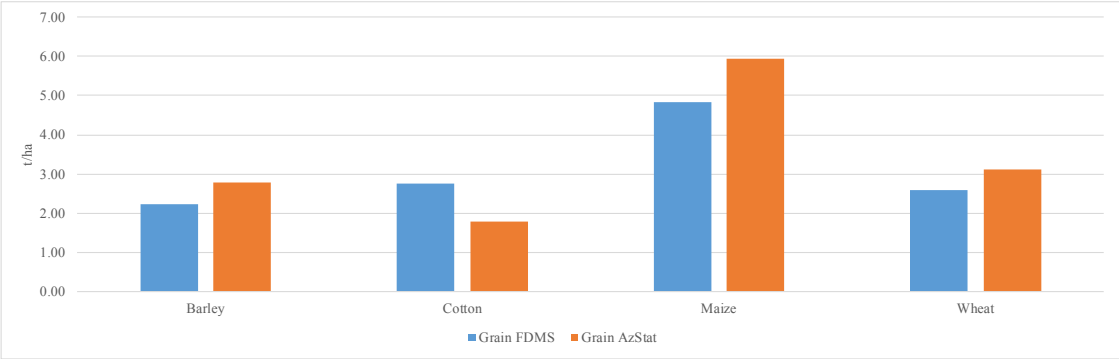

Figure 2. Arable crops yields- comparison with official statistics, t/ha (average 2015-2019)
Source: FDMS

It is interesting to note that most farmers in the FDMS sample use irrigation (80%). Wheat and barley producers dominate the sample with a 50% share. Irrigation use is lower than in the overall sample, but still high. One would expect dry farming to predominate in cereal production. Nevertheless, the difference in cereal yields between irrigated and non-irrigated plots is not significant for either barley or wheat. A steady increase in non-irrigated wheat yields was observed. The reason for this could be the use of better inputs such as seeds thanks to government support. It is also interesting to note that the yields of irrigated and non-irrigated cereals are moving in the same direction. The drastic decline in 2019 is probably due to reasons other than water availability (Fig. 3).

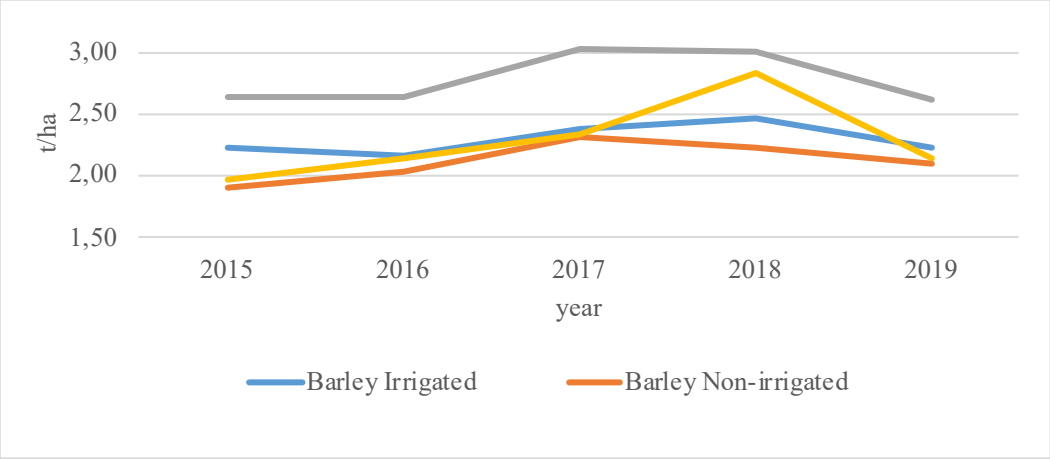

Figure 3. Effect of irrigation on the yields in wheat and barley
Source: FDMS

Now, FDMS enable analysis of revenues and costs on the level of the crop.

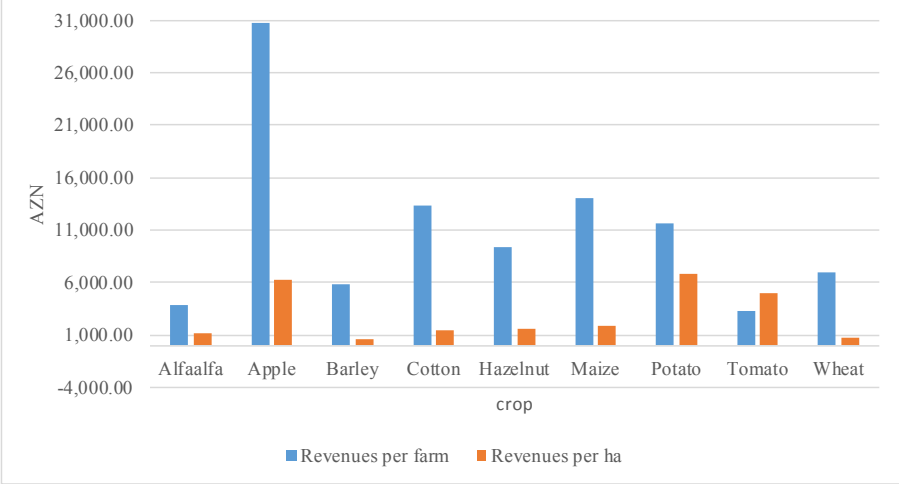

Figure 4. Average revenues (AZN for the period 2015-2019))
Source. FDMS and authors' calculations

The average revenues per crop in the case of grain is low. The revenues from wheat amounted to about eight hundred manat, that of barley to about six hundred manat. Corn revenues reached 1,800 manat. Large acreages contribute to high revenues per farm (seven, six and fourteen thousand manat per farm for wheat, barley, and maize respectively). The income from vegetables is much higher. For potatoes it is 6,800 manat and for tomatoes almost five thousand manat. The vegetable farms are smaller, but more efficient (Fig. 4).

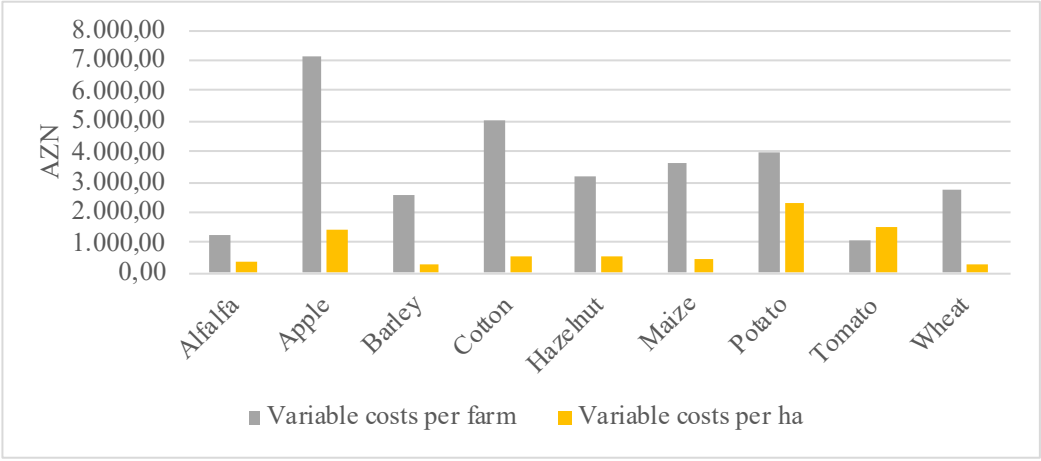

Figure 5. Average costs per ha (AZN for the period 2015-2019)
Source: FDMS and authors' calculations

Intensive vegetable and fruit cultivation is associated with high costs (Fig. 5). The high variable costs for wheat and barley could be due to the use of better, more expensive inputs that are available due to government support. They cannot be justified by the rapid increase in yields. The gross margin per hectare in cereal production (Fig. 6) is stable, while the gross margin per farm increased sharply in 2016 and 2019. A higher gross margin per hectare means that farms have increased acreage, but not productivity at the same pace.

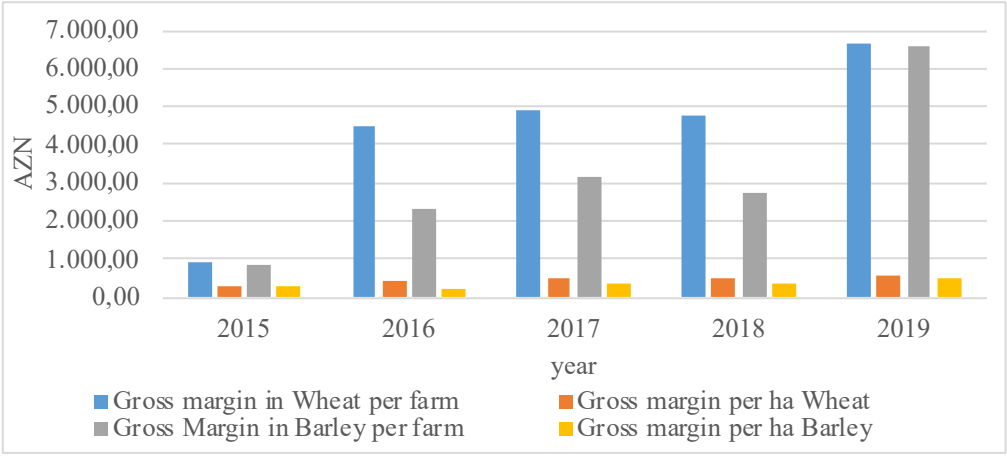

Figure 6. Gross margin per crop and ha (average 2015-2019)
Source: FDMS and authors' calculations

Considering that yields fell in 2019, could the increase in revenue be due to two things: higher prices or direct payments? Unfortunately, the amount of data does not provide an opportunity for a deeper analysis.

More detailed insights (Fig. 7) show that the increase in gross margin is mainly due to higher revenues.

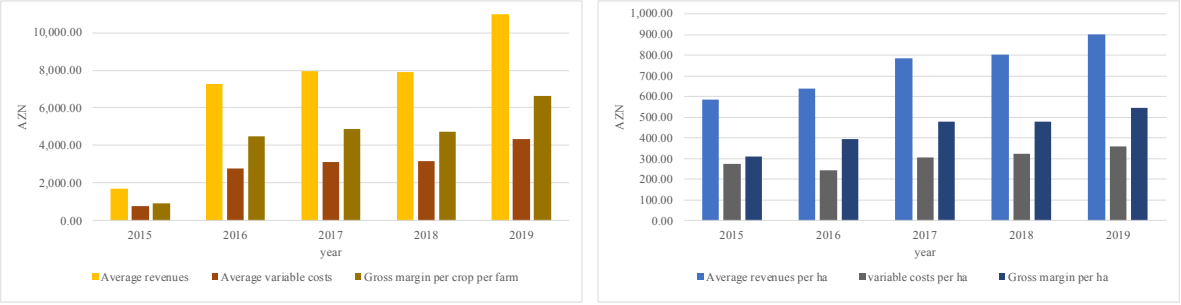

Figure 7. Gross Margin in wheat production (per farm and per crop)
Source: FDMS and authors' calculations

The gross margin in horticulture is much higher than in grain cultivation, reaching four thousand manat. It is between 5 and 10 times higher. But volatile! A negative gross margin was recorded for apples in 2019 (Figure 8). The gross margins of apples and hazelnuts are deteriorating. The number of apple growers in the sample is small and it is difficult to draw conclusions. The same applies to hazelnuts. Hazelnuts (among the crops analyzed) are the only products exported to the EU: Similar to apples, the gross margin for tomatoes has been declining since 2017.

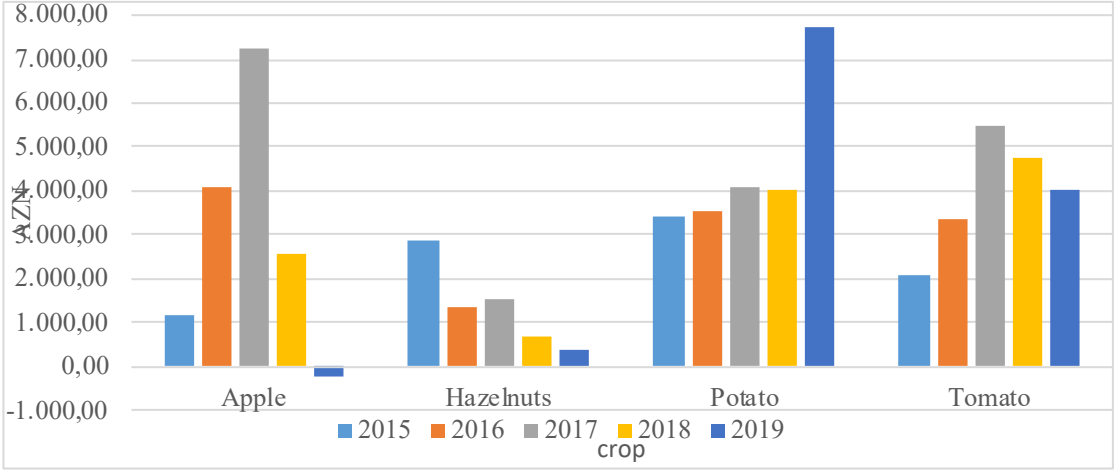

Figure 8. Gross margin in horticulture (AZN per ha)
Source: FDMS and authors' calculations

Farm-level data is very important for policy design, monitoring and evaluation, and farm management decisions. Examples include the analysis of economic challenges for agriculture, competitiveness, rural development measures and support for areas with natural constraints, environmental issues or the profitability of organic farming (OECD, 2011). Farm management decisions can include decisions on production mix, business planning, investment feasibility or benchmarking (Latruffe, 2010). Benchmarking is useful to determine the position of the farm compared to other farms in the country or region, compared to the previous period or compared to plans.

The FDMS data on prices and costs per 100 kg for wheat and potatoes are compared with the similar data available from AzStat for the private farm category. The prices and costs for wheat are comparable and converge over time (Table 1). We assume that AzStat uses similar categories of costs. In the case of potatoes, the differences are larger and with more extremes.

Table 1. Comparison between prices and costs between private enterprises from AzStat and farms in FDMS.

	Wheat				Potato			
	Selling price, AZN per 100 kg		Cost, AZN per 100 kg		Selling price, AZN per 100 kg		Cost, AZN per 100 kg	
	AzStat	FDMS	AzSta	FDMS	AzSta	FDMS	AzSta	FDMS
2015	20.40	29.70	12.86	3.26	46.24	42.12	27.38	15.50
2016	23.28	25.50	13.86	11.16	57.64	44.90	27.56	15.60
2017	26.27	29.20	12.40	10.81	46.33	43.47	35.78	17.20
2018	27.47	28.42	12.82	10.69	50.32	28.20	31.07	18.90
2019	31.83	34.30	15.53	17.70	54.68	49.32	65.23	21.20

Source: FDMS and AzStat

The regression analysis did not provide the existence of relationships between yield (dependent variable) and area per farm and irrigation availability (independent variables). R is 0.19, while R^2 is 0.03. The existence of a relationship between profit per hectare (y) and area per farm and irrigation (dummy) wasn't confirmed. R is 0.06 and R^2 is 0.003.

CONCLUSION

The aim of the paper was to present the potential of FDMS in analyzing the business results of Azerbaijani agriculture. In parallel, the paper discusses the importance of farm data collection for evidence-based policy making and further development of FDMS.

FDMS is a source of microeconomic data from the farms of Azerbaijan.

The analysis of business performance is based on FDMS data for the period 2015-2019.

Efficiency is measured by the yield level and gross margin achieved with different crops in different years and regions.

Yields are low compared to yields in developed countries and current technologies. Comparing the yields of arable crops in the FDMS and the State statistics, there is some consistency.

The revenue per crop (per farm and per ha) is higher for vegetables and fruit. The yields on farms with maize cultivation are very high. The same applies to wheat, barley and cotton. The reasons for this could lie in the large area under cereal cultivation.

Intensive vegetable and fruit cultivation is associated with high costs. Vegetable farms are smaller, but generally more efficient (higher income). The gross margin in horticulture is between 5 and 10 times higher. But volatile!

The regression analysis revealed no relationship between yield (dependent variable) and area per farm and availability of irrigation (independent variables). The existence of a relationship between profit per hectare (y) and area per farm and irrigation (dummy) was also not confirmed.

Small and fragmented family farms are difficult to capture, but it is a must to consider the multifunctional role of agriculture such as income generation, rural development, climate adaptation, biodiversity, employment and many more.

FDMS at the current level may be useful, but improvements are needed in human and material resources as well as in knowledge and reporting segments.

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Ekonomska učinkovitost najvažnijih usjeva u Azerbajdžanu

SAŽETAK

Cilj rada bio je procijeniti ekonomsku učinkovitost biljne proizvodnje u Azerbajdžanu. Analizirano je 20 tisuća skupova podataka iz Sustava za praćenje podataka poljoprivrednih gospodarstava (FDMS) za razdoblje 2015.-2019. Sukladno podacima, poljoprivredna gospodarstva koja se bave proizvodnjom povrća su manja, ali intenzivnija i učinkovitija. Proizvodnja žitarica je manje produktivna, a ostvareni dohodak po poljoprivrednom gospodarstvu i po hektaru je nizak. Odnosi između prinosa i površine po poljoprivrednom gospodarstvu i navodnjavanja kao i veze između dobiti po hektaru i površine po poljoprivrednom gospodarstvu i navodnjavanja nisu potvrđeni jednostavnom regresijom. Potencijalne buduće primjene FDMS-a mogle bi uključivati produktivnost, utjecaj subvencija na poslovne rezultate, konkurentnost i otpornost poljoprivrednih gospodarstava.

Ključne riječi: dohodak poljoprivrednog gospodarstva, doprinos pokriću, poljoprivredna gospodarstva, biljna proizvodnja, Azerbajdžan