Cost and gross profit analysis of wheat production: a case study of the Hatay Province of Turkey

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Abstract

This research was carried out in the Hatay province which is one of the most important agricultural production areas of Turkey. According to the data obtained from 104 agricultural enterprises, the average wheat yield was 555 kg/da, and the usage amounts of inputs in wheat production were as follows; 28.97 kg/da of seed, 345.55 cc/da of pesticides (herbicides, fungicides, insecticides), 72.34 kg/da of fertilizer, 16.14 lt/da of diesel fuel, 1.34 h/da of machine power, 1.42 h/da of labor force, and 51.54 KW/da of electricity. In addition to these, 2.45 daily workers were working per enterprise, and the average number of days worked was 7.9 days. The gross production value per unit area was found as 3640.80 TL/da, but with subsidies this value could increase 6.22% (226.5 TL/da). In the research area, the total production costs were determined as 2096.69 TL/da, and the cost per unit was revealed as 3.78 TL/kg. Among the cost factors, fertilizer (26.44%) was the highest cost item in wheat production (excluding land rent). Fertilizer cost per unit area was found as 554.34 TL/da. Other important cost items respectively were; seed cost at 148.52 TL/da (7.08%), diesel fuel cost at 140.63 TL/da (6.72%), harvest cost at 111.19 TL/da (5.30%), and pesticide cost at 87,43 TL/da (4.17%). According to the economic analysis results; when excluding subsidies, the gross profit per unit area was 2641.40 TL/da, the net profit was 1544.11 TL/da, and the relative profit was 1.74. When subsidies were included; the gross profit was 2687.90 TL/da, the net profit was 1770.61 TL/da, and the relative profit was 1.84. One of the most important findings of the research was that due to the high input prices, producers try to reduce their costs by reducing the use of fertilizer, the number of soil cultivation, and accordingly, the use of machine power. Therefore, there was a decrease in wheat yield comparing to previous years. As a result of the research, in order to make wheat production more profitable and to increase the production amount, concrete steps should be taken to especially reduce fertilizer and energy costs. Producer organizations should take an active role in input supply, and unit prices of subsidies should be revised to be at the level of developed countries.

Keywords: Wheat. Cost. Subsidy. Profitability. Input. Hatay. Turkey.

1. Introduction

Grains have played an important role in human nutrition throughout human history. Wheat is one of the three most widely grown cereal crops in the world, along with barley and

corn. Wheat cultivation began 10,000 years ago in the Southeast Anatolian Region of Turkey (Mesopotamia) and spread to the world from there (Yara, 2021). Today, there are 15 wheat species and around 30 thousand wheat varieties grown in the world. The wheat types produced economically are divided into 3 basic groups; durum wheat (triticum durum), bread wheat (triticum aestivum), and biscuit wheat (triticum compactum) (Duru et al., 2019).

Wheat production is also important in its homeland of Turkey. According to the data of 2021, Turkey met 3.00% of the total wheat cultivation area and 2.29% of the production amount of the world (FAO, 2023). The demand for wheat, which is used in the production of staple foods such as bread and pasta, has grown rapidly in Turkey; especially with the immigration from Syria that started in 2013 which resulted in an escalation in population. This situation caused a shortage in the wheat supply and an increase in wheat imports accordingly. Eventhough Turkey was one of the top ten countries in wheat production in the world by 2022; it is also the 3rd largest wheat importer with 11 million tons after China (14 million tons) and the European Union (11.5 million tons) (USDA, 2023). The total wheat import value in the world was 63.29 billion USD in 2021 and Turkey's wheat import value was 2.69 billion USD (4.25%) (FAO, 2023). While some of the imported wheat is used to meet the domestic demand; the other part is processed within the Inward Processing Regime (IPR), which is an export incentive system, and is exported as bakery products such as flour and pasta (FAO, 2023; Duru et al., 2019). Turkey exported 5.27 million tons of flour and bakery products in 2021 and received 3.23 billion dollars of export income (MAF, 2022a). In the 2021/22 season, Turkey's self-sufficiency rate in wheat production was 87.26%. Futhermore, wheat production areas have been shrinking over the years (TSI 2023a; TSI, 2023b).

The Hatay province is one of the areas with a high agricultural production potential in Turkey, and field crops have an important place in the production pattern of the area. Field crops are grown on 53% of the total agricultural land in Hatay. Cotton and wheat are the two most important field crops grown in the province. According to Turkish Statistical Institute (TSI) data for 2021; a total of 247,960 tons of wheat was produced in an area of 540,988 da in Hatay, and this amount constitutes 1.38% of Turkey's total wheat production (TSI, 2022). The aim of this study was to determine the input usage levels, input costs, and profitability in wheat production in the Hatay province. As well as to propose solutions to increase production.

2. Literature Review

There are many studies conducted in Turkey and in the world on different subjects of wheat production such as; the cultivation, energy use, economic analysis, foreign trade, and economic importance. Some of these analyses are given below.

A research was led by Arısoy (2004) with 67 enterprises in order to make an economic analysis of wheat production in the Konya province of Turkey. The return on equity was determined as 5.16%, the economic profitability as 5.10%, and the yield as 349 kg/da.

Birinci and Küçük (2004) carried out a study in the Erzurum province of Turkey, where an average of 12.85 hours/da of labor force and 5.71 hours/da of machine drawing power were used for wheat production. The workforce required for harvesting-threshing was 81.72%, 11.65% in maintenance, and 6.63% in soil preparation and planting processes. The distribution of machinery power was 76% in harvesting-threshing and transportation, and 24% in soil preparation works. It was found that 13.2% of the costs belong to labor costs.

An analysis was directed by Bayramoğlu et al. (2005) in the Tokat province of Turkey, where the production inputs and costs of some important field products (sunflower, wheat, onion, and sugar beet) were compared. According to the results of the research, it was observed that the physical labor input needs of wheat (soil preparation, maintenance, harvest-threshing) were lower than other products. Also in the study, the production cost of wheat products was found as 99,873 TL/da; the gross production value was 129,103 TL/da; the net profit was 29,230 TL/da; and the proportional profit was 1.29 TL/da.

Hussain et.al. (2010) executed a research in Pakistan, where the energy needs of wheat production in traditionally irrigated lands and in raised beds were compared. According to the results of the research, it was discovered that 6% more energy input was needed in wheat production on lands irrigated with traditional methods.

In a study administered in Pakistan-Peshawar by Iqbal et al. (2015), wheat production cost was calculated. It was determined that 35.2% of the total wheat production costs consisted of fertilizer, 30.30% was on land rent, and 15.1% on soil preparation.

Zhang et al. (2016) organized an investigation in China; where it was concluded that the costs of fertilizer, irrigation, and machinery use significantly affected the cost of wheat production, but the labor costs relatively did not.

An analysis was directed by Ansari et.al. (2018) in Pakistan to observe the energy efficiency of wheat production. Most of the energy was spent during the extraction of irrigation water and agricultural spraying. The energy use efficiency was found as 7.478 and the energy efficiency as 0.181 kg MJ^{-1}.

Altuntaş et al. (2019) conducted a study in the Sivas province of Turkey to investigate the energy use efficiency in wheat production. It was discovered that the energy use in order from highest to lowest was; chemical fertilizer energy, seed energy, and fuel and oil energy.

Foreign trade of wheat and wheat products in Turkey were examined by Duru et al. (2019). In the research, it was stated that due to the low capacity utilization rate in the sector, the Inward Processing Regime or IPR (a system based on importing intermediate goods or inputs to export finished products) was applied. Accordingly, the wheat imports and exports of wheat products increased.

In a research by Saini et al. (2019) in the Haryana region of India, the economic analysis of wheat and paddy productions were investigated. According to the results of the study, it was determined that the profitability ratios of large-scale enterprises are higher than medium and small-scale enterprises.

Erbaş (2020) led an examination to analyze the cost of winter wheat production in the Yozgat province of Turkey. It was discovered that 216.73 kg of main product and 221 kg of by-product (hay) per decare were obtained. The production cost was 0.75 TL/kg, and the average sale price was observed as 0.85 TL/kg. It was also found that 84.33% of the costs in wheat production were variable costs. In addition, the gross profit from wheat production was calculated as 51.50 TL/da and the net profit as 19.44 TL/da.

3. Materials and Methods

3.1. Materials

The main material of the research consists of primary data obtained by the face-to-face survey method from wheat producing businesses in the Hatay province. The sample size was determined by the Simple Random Sampling Method. Also, within the study, secondary data were used from the databases and reports of institutions such as the Turkish Statistical Institute (TSI), the United Nations Food and Agriculture Organization (FAO), the United States Department of Agriculture (USDA), and previous studies on the subject. In the analysis, input usage in wheat production, the production costs, gross production value, gross profit, and net profit values were examined.

3.2. Methods

3.2.1. Sampling method

According to the data of 2021, which were obtained from the Farmer Registration System of Hatay Provincial Directorate of Agriculture and Forestry, the total wheat production area in Hatay was 359,106 decares and the number of producers were 23,301. The distribution of wheat production areas of the Hatay province by districts are as follows; Kırıkhan: 34.61%, Antakya: 21.46%, Reyhanlı: 14.63%, Kumlu: 8.82%, Altınözü: 5.46%, Hassa: 5.31%, and Yayladağı: 4,70%. Due to these 7 districts providing approximately 95% of the wheat production area, and also containing 92% of the producers in the Hatay province, it was decided to conduct the research in the districts mentioned above.

The 'Simple Random Sampling Method' was used to determine the sample size of the research, and the formula of the method is given below (Çiçek and Erkan, 1996; Yamane, 2010);

$$n = \frac{NS^2\ t^2}{(N-1)d^2 + S^2\ t^2}$$

In the formula;

n: Sample size

N: Total number of units in the sampling frame

S: Standard deviation

t: Confidence limit

d: Acceptable error

According to the Simple Random Sampling Method formula, the number of surveys with a 90% confidence interval and a 10% standard deviation, was determined as 104. In the distribution of the number of surveys according to the districts, the proportional share of each district in the province's total number of enterprises, was taken into consideration. According to this, 104 surveys were distributed by the districts as follows; Kırıkhan: 27, Antakya: 27, Altınözü: 14, Yayladağı: 13, Reyhanlı: 11, Hassa: 7, and Kumlu: 5 surveys. The distribution of the number of surveys applied by districts is given in Table 1.

Table 1: Distribution of the number of surveys between districts in the research area

Districts	The number of producers	Ratio in the research area (%)	The number of surveys
Kırıkhan	5491	25,78	27
Antakya	5471	25,68	27
Altınözü	2916	13,69	14
Yayladağı	2598	12,20	13
Reyhanlı	2246	10,54	11

Hassa	1563	7,34	7
Kumlu	1016	4,77	5
Total	21301	100	104

3.2.2. The method used in cost calculation

3.2.2.1. Production cost items

Production costs consist of fixed and variable costs. Variable costs are the costs that vary depending on the production volume and are usually easily allocated to production. Fixed costs are the costs calculated for inputs that do not depend on the production volume and provide more than one period of service flow (İnan, 2016). Within the study, land rent, administrative expenses, and product insurance were taken into account as fixed cost items. Variable cost elements were; soil preparation, seed and seed planting, fertilizer, pesticide, temporary labor, diesel fuel, electricity, harvest, transportation, and interest on capital.

3.2.2.2. Determination of production inputs

The data obtained from the enterprises in the research area were analyzed and the average input amounts used in wheat production were found per unit area (da). Unit product costs were revealed after input amounts and production costs used in wheat production were determined. In the analysis of input usage; the seeds, chemical fertilizers and chemical pesticides, and diesel fuel used in wheat production, and their prices, were taken as basis (Tanrıvermiş, 2000). In the calculation of current expenses, the current prices of the inputs at the time were used.

3.2.2.3. Calculation of production costs

Within the research, wheat cost was calculated according to the method given below (Yılmaz, 1997; Semerci, 1998; Özkan and Yılmaz, 1999; Yılmaz and Yılmaz, 1999; İnan, 2016; Semerci and Çelik, 2018; Semerci, 2020);

Gross Production Value (GPV*): Main product [Yield (kg/da)*Product sale price (TL/kg)

(*): Since the economic analysis of wheat production was the main focus of the study, only wheat production value was taken into account as the gross production value of the product. Hay, which is a by-product of wheat production, was not included in the calculations.

Variable cost items: Soil preparation + Seed and seed planting + Fertilizer and fertilizer application + Pesticide and agricultural spraying + Irrigation cost + Labor cost + Harvest + Transportation + Interest on capital**.

(**): Interest on capital: (Variable costs) x (%2,65).

(**): The annual interest rate of the Agricultural Bank of Turkey was 4% for crop production in 2021, and the share of the wheat production period was taken into consideration in the calculations.

Fixed cost item: Land rent value (***) + Administrative expenses (****) + Product insurance.

(***): Rental value of the land leased by business owners in wheat production, or the rental values of their own lands were taken into consideration according to the alternative cost principle.

(****) Administrative expenses: (Total production cost) x (3%)

Total production cost: Variable costs + Fixed costs

Gross profit: Gross production value – Variable costs

Net profit: Gross production value - (Variable costs + Fixed costs)

Relative profit: Gross production value / Production costs

Within the research, the following formulas were used to calculate the Total Factor Productivity (TFP) (Mc Connell and Dillon, 1997);

Gross TFP= Total gross production value / Total production cost

Net TFP= Total net profit / Total production cost

4. Results and Discussions

4.1. Wheat production in the world and Turkey

According to the data obtained from the FAO, in 2021, 770.9 million tons of wheat was produced in a 220.8 million ha area in the world. When examined by years, there was no significant change in the world's wheat cultivation areas. However, with the advancement of agricultural technologies and the development of better quality seeds, an increase in wheat yield values, and therefore production amounts, were observed (Table 2).

Table 2: Wheat production in the world

Criteria	Seasons						
	2005	2010	2015	2018	2019	2020	2021
Cultivation area (millions ha)	221.7	215.6	223.3	213.8	215.7	217.9	220.8
Production (millions ton)	627.0	640.8	741.8	732.2	764.1	756.9	770.9
Yield (tons/ha)	2.83	2.97	3.32	3.42	3.54	3.47	3.49

Source: FAO, 2023.

The distribution of wheat production in the world by countries is given in Table 3. In 2021, a total of 771 million tons of wheat was produced on approximately 221 million hectares of area in the world. The world's five largest wheat producer countries were respectively; China (17.76%), India (14.22%), Russia (9.87%), USA (5.81%), and France (7.74%). These five countries met more than half of the world's total wheat production (52.40%), and Turkey ranked 11th in 2021 with 17.65 million tons of wheat production.

Table 3: Distribution of wheat production in the world by countries (2021)

Countries	Production Area (ha)	Quantity (tons)	Yield (kg/da)	Ratio (%)
China	23,568,400	136,946,000	5,811	17.76
India	31,610,000	109,590,000	3,466	14.22
Russia	27,916,725	76,057,258	2,724	9.87
USA	15,039,490	44,790,360	2,978	5.81
France	5,276,730	36,559,450	6,928	4.74
Ukraine	7,099,400	32,183,300	4,533	4.17
Australia	12,643,216	31,922,555	2,525	4.14
Pakistan	9,168,249	27,464,081	2,996	3.56
Canada	9,247,000	22,296,100	2,411	2.89
Germany	2,939,000	21,459,200	7,301	2.78
Turkey	6,623,061	17,650,000	2,665	2.29
Argentina	6,394,102	17,644,277	2,759	2.29
Others	63,234,369	196,314,492	-	25.48
World	220,759,742	770,877,073	3,492	100.00

Source: FAO, 2023.

The comparative values of wheat production in the world and Turkey are given in Table 4. While Turkey constituted 3.00% of the total production area in the world with 6.62

million hectares in 2021, it provided 2.29% of the total wheat production in the world with 17.65 million tons. The world's yield average was 349 kg/da in 2021, and Turkey was below the world average with 266 kg/da.

Table 4: Wheat production in the world and Turkey (2021)

Criteria	Turkey	World	Ratio (%)
Cultivation area (ha)	6,623,061	220,759,742	3,00
Quantity (tons)	17,650,000	770,877,073	2,29
Yield (kg/da)	266	349	-

Source: FAO, 2023.

The values of Turkey's wheat production by years are given in Table 5. Turkey's wheat cultivation areas have been shrinking over the years. Wheat cultivation areas shrunk by 28.34% between 2005 and 2022, while the decrease in production was relatively limited due to the increase in yield values. Turkey's wheat yield, which was 235 kg/da in 2005, reached 296 kg/da in 2022 with an increase of approximately 26% due to developing production technologies and the use of better quality seeds. In addition, the total amount of wheat production is around 20 million tons on average, though there have been fluctuations over the years.

Table 5: Wheat Production of Turkey by Years (2005-2022)

Years	Cultivation area (ha)	Index	Quantity (000 tons)	Index	Yield (kg/da)	Index
2005	9,250,000	100.00	21,500	100.00	235	100.00
2010	8,103,400	87.60	19,674	91.51	241	102.55
2015	7,866,887	85.05	22,600	105.12	281	119.57
2020	6,922,236	74.84	20,500	95.35	292	124.25
2021	6,323,437	68.36	17,650	82.09	266	113.19
2022	6,628,739	71.66	19,750	91.86	296	125.96

Soruce: TSI, 2023a; FAO, 2023.

The distribution of Turkey's wheat production in 2022, by provinces, is given in Table 6. In 2022, 19.75 million tons of wheat was produced in total on 6.6 million hectares of area in Turkey. The first ten provinces with the highest wheat production in Turkey respectively are; Konya, Şanlıurfa, Ankara, Tekirdağ, Diyarbakır, Mardin, Yozgat, Sivas, Çorum, and Adana. These ten provinces cover 41.47% of Turkey's total wheat cultivation area and 43.28% of the production total.

Table 6: Major provinces of wheat production in Turkey (2022)

Province	Cultivation area (ha)	Quantity (000 tons)	Yield (kg/da)
Konya	579,411	1,929	335
Şanlıurfa	292,248	1,008	332
Ankara	366,717	896	247
Tekirdağ	192,872	812	421
Diyarbakır	276,517	799	281
Mardin	189,232	744	368
Yozgat	288,442	669	227
Sivas	238,968	586	243
Çorum	182,704	561	314
Adana	141,931	544	385
Others	3,879,697	11,202	-
Turkey	6,628,739	19,750	296

Source: TSI, 2023a

Turkey's foreign trade figures for wheat and wheat products are given in Table 7. Turkey's wheat import is on an increasing trend over the years. While Turkey's wheat import value was approximately 1.04 billion USD in 2017, this value reached 2.44 billion USD in 2021. While some of the imported wheat is used to meet the domestic demand, a large part of it is exported after being processed into finished products such as; flour, pasta, bulgur, semolina, and biscuits. In 2021, processed wheat products costing 3.23 billion USD were exported.

Table 7: Turkey's wheat and processed wheat products foreign trade

Years	Wheat import		Processed product export	
	Quantity (tons)	Value (000 USD)	Quantity (tons)	Value (000 USD)
2017	4,990,009	1,042,620	7,347,840	2,611,344
2018	5,781,340	1,289,013	7,416,177	2,691,954
2019	9,804,714	2,265,905	7,511,956	2,877,584
2020	9,748,781	2,364,183	7,497,511	2,959,330
2021	8,137,984	2,440,168	7,352,105	3,234,898

Source: MAF, 2022a

When Turkey's exports of processed wheat products are analyzed (Table 8); Turkey's export income value was 3.23 billion USD in 2021 for a total of 5.27 million tons of processed wheat products, mainly flour and pasta.

Table 8: Distribution of Turkey's processed product exports

Years	Flour (tons)	Pasta (tons)	Bulgur (tons)	Semolina (tons)	Biscuits (tons)	Total (tons)	Value (000 USD)
2018	3,308,362	1,206,750	262,094	80,152	467,961	5,325,320	**2,691,954**

2019	3,262,133	1,272,881	262,615	81,461	520,667	5,399,757	**2,877,584**
2020	2,989,555	1,472,454	282,486	80,266	534,823	5,359,584	**2,963,507**
2021	3,003,746	1,364,756	238,139	102,135	566,295	5,275,071	**3,234,898**

Source: MAF, 2022a.

Although Turkey is generally self-sufficient in wheat production, there are fluctuations in self-sufficiency ratios due to the shrinkage of wheat production areas, and some global crises such as the Covid-19 pandemic, and the war between Russia and Ukraine. In the season of 2019/20, the year the Covid-19 pandemic emerged, Turkey's self-sufficiency rate decreased to 89.46% due to the supply deficit. Again it decreased to 87.26% in 2022 due to the global wheat supply crisis when the Russian-Ukrainean war started (Table 9). This situation once again revealed the importance of being self-sufficient in the production of staple foods such as cereals and oil seeds.

Table 9: Turkey's wheat consumption, stock change, and sufficiency level by years

Marketing year	Domestic use (tons)	Seed use (tons)	Human consumption (tons)	Losses (tons)	Change in stocks (tons)	Human consum (kg
2010/11	18,187,098	1,458,612	15,766,287	557,758	1,350,836	
2011/12	19,609,603	1,457,280	17,089,529	614,392	238,853	
2012/13	19,375,457	1,355,335	17,042,330	566,716	-52,000	
2013/14	20,461,694	1,399,068	16,329,709	621,267	-117,110	
2014/15	20,121,780	1,425,458	15,604,364	535,531	-744,591	
2015/16	18,795,419	1,416,040	14,399,259	636,835	752,701	
2016/17	18,756,436	1,380,950	14,490,086	580,589	-2,167,000	
2017/18	18,186,979	1,380,398	14,107,643	605,839	750,426	
2018/19	18,804,861	1,313,869	14,714,796	563,692	-1,310,753	
2019/20	20,069,822	1,232,339	16,034,511	535,673	1,147,728	
2020/21	18,934,082	1,246,003	14,782,565	566,563	1,092,634	
2021/22	19,114,670	1,214,040	15,184,041	571,479	-808,651	

Source: TSI, 2023b

4.2. Subsidy policies for wheat production in Turkey

Policies for the agricultural sector in Turkey mainly constitute support purchase prices and subsidy policies. Applications within the agricultural policies are generally supportive in the domestic market and protective in the foreign market.

There are three main forms of subsidies that are applied for wheat production in Turkey. These are;

1- Deficiency payments

2- Area based subsidies (diesel fuel and fertilizer subsidies)

3- Certified seed usage subsidy

Deficiency payments: The main aims of the deficiency payments system are; to ensure the continuation of production by paying producers above world prices, to supply the raw materials with world prices that are needed by the domestic industries, to register the enterprises/farmers, and to keep agricultural records and inventory**.** In the deficiency payment system, the government does not intervene in the market, but instead supports the producer by paying a certain premium for each unit of the product according to the determined target price (Özüdoğru, 2005).

Area based subsidies (diesel fuel and fertilizer subsidies): Area based subsidies consist of payments for diesel fuel and fertilizer which is based on the producer's registered agricultural land size for that specific production season.

Table 10: Wheat subsidy prices for the season of 2021/22

Subsidies	Subsidy value (TL)
Area based subsidies	
Diesel fuel subsidy (TL/da)	75.00
Fertilizer subsidy (TL/da)	46.00
Deficiency payment (TL/kg)	0.10
Certified seed usage subsidy (TL/da)	50.00

Source: MAF, 2022b.

4.3. Wheat Production in the Research Area

4.3.1. General Information About Wheat Production in the Research Area

The distribution of wheat production in the Hatay province in 2022, by districts, is given in Table 11. In 2022, 188,531 tons of wheat was produced in a 491,122 decare area in the Hatay province. The main districts where wheat production takes place are respectively; Kırıkhan, Antakya, Altınözü, Reyhanlı, Hassa, and Kumlu. These six districts meet 86.79% of the total wheat amount grown in the province (TSI, 2023a).

Table 11: Information about wheat production in the Hatay province by districts (2022)

Districts	Cultivation area (da)	Ratio (%)	Quantity (tons)	Ratio (%)
Kırıkhan	116,460	23.71	46,274	24.54
Antakya	92,500	18.83	42,943	22.78
Altınözü	93,413	19.02	27,574	14.63
Reyhanlı	50,000	10.18	20,587	10.92
Hassa	30,879	6.30	14,203	7.53
Kumlu	25,231	5.14	12,046	6.39
Arsuz	22,900	4.67	10,620	5.64
Yayladağı	29,950	6.10	3,604	1.91
Samandağ	8,600	1.75	2,668	1.41
İskenderun	7,589	1.54	2,637	1.40
Belen	5,700	1.16	2,546	1.35
Erzin	3,500	0.71	1,218	0.65
Dörtyol	2,618	0.53	1,006	0.53
Defne	1,300	0.26	394	0.21
Payas	482	0.10	211	0.11
Total	**491,122**	**100.00**	**188,531**	**100.00**

Source: TSI, 2023a.

The demographic characteristics of the producers in the research area are; the average producer age was 51.63, the average education level was 8.29 years, the average experience in wheat production was 27.58 years, and the average household size was 4.69.

The production pattern distribution of the agricultural enterprises in the research area is given in Table 12. According to the research findings, cotton production was in first place with 20,543 da of area (45.69%), wheat was in second place with 16,539 da (36.78%), and corn was in third place with 5,612 da (12.48%).

Table 12: Production Pattern of the Research Area

Products	Cultivation area (da)	Ratio (%)
Cotton	20,543	45.69
Wheat	16,539	36.78
Corn	5,612	12.48
Vegetables	542	1.21
Carrots	450	1.00
Olives	393	0.87
Potatoes	393	0.87
Fruits	195	0.43
Soybeans	130	0.29
Peanuts	100	0.22
Feed crops	70	0.16
Total	**44.967**	**100.00**

General information about the wheat production of agricultural enterprises in the research area is given in Table 13. According to the results; the average number of temporary employees per enterprise in the research area was 2.45, the average number of days temporary employees worked in wheat production was 7.9 days, the average width of the total cultivation area size was 433.19 da, the average wheat production area size was 159.03 da, and the average wheat yield was calculated as 555 kg/da.

Table 13: General Information About Wheat Production in the Research Area

Criteria	N	Average	Standard Deviation
The number of temporary workers	102	2.45	1.264
The number of days worked	103	7.90	4.854
Total cultivation area size (da)	104	433.19	448.405
Wheat cultivation area size (da)	104	159.03	131.681
Wheat yield (kg/da)	104	555.00	131.453
Rental land size (da)	86	72.49	101.668

4.3.2. Input usage and cost in wheat production

In the research area, in order to obtain an average of 555.00 kg of wheat from the unit area; 28.97 kg/da of seed, 72.34 kg/da of fertilizer, 345.55 cc/ha of pesticides, 16.14 lt/da of diesel fuel (soil preparation + planting + careworks + irrigation), 51.41 kw/da electricity, 1.34 h/da machine power, and 1.42 h/ha of labor force were used.

The cost chart calculated for the wheat produced in the research area is given in Table 14. According to the calculations, the variable costs total was found as 1179.40 TL/da, the fixed costs total was 917.29 TL/da, and the total production cost was found as 2096.69 TL/da. In order of importance the costs were; land rent (40.68%), fertilizer (26.44%), seeds (7.08%), harvest (5.30%), pesticides (4.17%), and soil preparation/sowing (4.13%).

Table 14: Cost of wheat production per unit in the research area

Operations	Average value (TL/da)	Ratio (%)
A. Variable costs		
Soil preparation/sowing	86.51	4.13
Seed	148.52	7.08
Care Works		
Fertilizer	554.34	26.44
Fertilizer application	17.30	0.83
Pesticide	87.43	4.17
Agricultural spraying	11.54	0.55

Irrigation (labor cost)	42.84	2.04
Irrigation (diesel fuel cost)	25.28	1.21
Irrigation (electricity cost)	28.94	1.38
Harvest	111.19	5.30
Transportation	35.06	1.67
Subtotal	1,148.95	-
Interest on capital (%2,65)	30.45	1.45
Variable costs total	**1,179.40**	**56.25**
B. Fixed costs		
Administrative expenses (%3)	35.38	1.69
Product insurance	29.00	1.38
Land rent	852.91	40.68
Fixed costs total	**917.29**	**43.75**
C. Production cost total	**2,096.69**	**100.00**
Yield (kg/da)	555.00	-
Unit cost (TL/kg)	3.78	-

(Exchange rate average for 2022; 1 USD =16.57 TL)

The economic analysis results of wheat production in the research area are presented in Tables 15 and 16, excluding and including subsidies. According to the calculations, wheat gross production value per unit area was found as 3640.80 TL/da. With the subsidies this value increases by 6.22% and becomes 3867.30 TL/da. Excluding subsidies, gross profit per unit area was 2641.40 TL, net profit was 1544.11 TL, and relative profit was 1.74. When agricultural subsidies were included; gross profit was calculated as 2687.90 TL, net profit as 1770.61 TL, and relative profit as 1.84.

Table 15: Economic analysis results of wheat production (subsidies excluded)

Criteria	**Average value (TL/da)**
Yield (kg/da)	555.00
Unit sale price (TL/kg)	6.56
Gross production value (TL/da)	3,640.80
Variable costs (TL/da)	1,179.40
Fixed costs (TL/da)	917.29
Production cost total (TL/da)	2,096.69
Unit cost (TL/kg)	3.78
Gross profit (TL/da)	**2,461.40**
Net profit (TL/da)	**1,544.11**
Relative profit	**1.74**

Table 16: Economic analysis results of wheat production (subsidies included)

Criteria	Average value (TL/da)
Yield (kg/da)	555.00
Unit sale price (TL/kg)	6.56
Gross production value (TL/da)	3,640.80
Area size based subsidies (diesel fuel and fertilizer-TL/da)	121.00
Deficiency payment TL/da (0,10 TL/kg x yield)	55.50
Certified seed usage subsidy (TL/da)	50.00
Gross production value (TL/da) "*subsidies included*"	3,867.30
Variable costs (TL/da)	1,179.40
Fixed costs (TL/da)	917.29
Production cost (TL/da)	2,096.69
Unit cost (TL/kg)	3.78
Gross profit (TL/da)	**2,687.90**
Net profit (TL/da)	**1,770.61**
Relative profit	**1.84**

The calculations indicate that the contribution of the subsidies provided by the Ministry of Agriculture and Forest for wheat production (difference payment, diesel fuel and fertilizer, certified seed usage) for producer income is at a limited level (6,22%). One of the most important precautions that can be taken in terms of increasing wheat production; is taking the rules of the World Trade Organization into account, and increasing the deficiency payment unit prices, especially for staple food products such as wheat, corn, oil seeds, etc.

4.4. Total factor productivity of the enterprises in the research area

Within the research, in order to calculate the Total Factor Productivity (TFP), the formulas specified by Mc Connell and Dillon (1997) were used. Accordingly, in wheat production, the Gross TFP was calculated as 1.84 and the Net TFP as 0.84.

Gross TFP = Total Gross Production Value/Total Production Cost=3,867.30 TL/2,096.69= 1,84

Net TFP = Total Net Profit/Total Production Cost=1,770.61 TL/2,096.69 TL= 0,84

5. Conclusions and Recommendations

In this study, wheat production; which has the highest share in field crops after cotton in the Hatay province, was examined. Within the research, it was observed that the producers were generally satisfied with wheat production, especially since it is easier to grow than other products and requires less labor. However, due to the rapid increase in the exchange rates in recent years (2021 average: 1 USD=8.89 TL; 2022 average: 1 USD =16.57 TL), input prices went up sharply, especially the ones that are imported or have prices based on the USD such as diesel fuel, fertilizer, pesticides, and seeds. Hence, the producers tried to reduce their costs by reducing the use of fertilizer, soil cultivation, and accordingly, the use of machine power. Consequently, there was a decrease in wheat yield.

Wheat production is an activity with high profitability in general, and 62.50% of the producers stated that they are satisfied with wheat production. However, 40.38% of the producers stated that their profitability was decreasing compared to previous years due to the increase in costs, and that they will narrow their wheat cultivation areas in the next year.

In the research area, wheat production was carried out on a total of a 16,539 da area, with a 555 kg/da average yield. The revenue (GPV) subsidies included from wheat production was determined as 3867.30 TL/da, total production cost as 2096.69 TL/da, and the cost per unit was found as 3.78 TL/kg. Distribution of input items in the cost per unit area in wheat production (excluding land rent) were respectively; fertilizer (26.44%), seed (7.08%), diesel fuel (6.72%), harvest (5.30%), and pesticide (4.17%).

When subsidies were excluded, the gross profit per unit area was 2641,40 TL/da, the net profit was 1544,11 TL/da, and the relative profit was 1,74. When subsidies were included; the gross profit was 2687.90 TL/da, the net profit was 1770.61 TL/da, and the relative profit was 1.84.

Wheat production areas have been decreasing over the years in Turkey, which is its homeland. In the last 17 years (2005-2022), wheat cultivation areas have decreased by 28%. Although there were minor fluctuations between 2005 and 2022, it is observed that Turkey's annual total wheat production remained stable at around 20 million tons. In the mean time, Turkey's population, which was 68 million in 2005, reached 85 million by 2023 with an increase of 25%. Furthermore, with around 10 million refugees in Turkey and millions of tourists hosted every year, the population that Turkey has to feed easily exceeds 100 million. This situation increases the importance of wheat production, which is the raw material of important staple foods such as bread and pasta. For this reason, it is of great importance that wheat, which is one of the strategic agricultural products, is produced with the country’s own resources without being dependent on foreign sources.

Especially during the Covid-19 pandemic, due to the logistical problems and concerns such as the inability of countries to meet their own domestic demands, the global wheat foreign trade volume shrunk drastically. This once again brought to light the importance of meeting the demand of staple food products within domestic resources.

Turkey is the 3rd largest wheat importer in the world. However, due to the rising exchange rates in recent years, meeting the supply deficit of agricultural products through import has lost its advantage.

Increasing the amount of production by incentive agricultural policies will reduce foreign dependency, and contribute to the increase in revenues from the export of processed wheat products. Therefore, in order to increase wheat production, it is important to revise unit prices of agricultural subsidies for wheat production according to today's input price conditions.

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