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Profit Forecasting in Crop Production: The Case of Gazipaşa

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Abstract

Agriculture sector in Turkey is among the largest, employing one out of every five working people. In this study agricultural crop income of Turkey's Gazipaşa district is analyzed. Located on the coast of the Mediterranean, the district's main economy is based on agriculture with 81 different crops currently cultivated in 43 regions. For each crop type, total planted land size, yield, wholesale price and operating costs are determined using the data from Turkish Statistical Institute and the district's Directorate of Agriculture. Crop types are ranked based on their economic returns and top 30 that corresponds to 96.45% of the total agricultural income are determined. Profit forecasts are made for those 30 crop types for each of the next 15 years. Future wholesale prices are forecasted using linear trend projection. The annual agricultural loan interest rate of 7.5% is used to estimate the increase in operating costs. Results show that the annual total profit increases slowly in the next 11 years and then decreases. Moreover, profitability increases only for 18 out of the 30 crop types. Internal rate of return is also found to be 15%. Findings suggest that the current crop diversity is not economically sustainable and a better agricultural production plan is required.

Keywords: Agricultural production, Crop profitability, Forecasting

Introduction

Agricultural production maintains its importance in today's world with domestically increased crop consumption rates and fierce competition for reaching global food markets. Agriculture is among the most important economic sectors also in Turkey. According to the Turkish Statistical Institute (TUIK), the sector employs 20% of the national active work force. The area of the total agricultural land in Turkey is around 23.3 million ha with an average value of 683 Turkish Lira per decare. Turkey is also among the major exporters of agricultural products in Eastern Europe, Near East and North Africa (Ucak, 2006).

As in other countries, demand for agricultural products in Turkey has increased not just in quantity but also in variety in recent years. Country's one of the important regions that can provide crop variety is the Gazipasa district. Located in southern Turkey, the district is within the boundaries of Antalya province and its population is mostly engaged in agricultural production. The altitude of Gazipasa is between 0-2200 meters and this allows a wide variety of climates from tropical to continental. As a result, crops like wheat as well as fruits like mango and dragon fruit can well be grown in the district. It is also one of the rare regions in Turkey where products like banana and avocado are commonly grown. According to TUIK's 2018 Agricultural Production Data, more than 80% of Turkey's outdoor banana production comes from Gazipasa. Moreover, around 141.5 thousand decares of land in the district are cultivated for agricultural activities with an average of 5,335 TL agricultural production value per decare. The district's agricultural output corresponds to 755 million TL per year which constitutes 0.5 % of the total produced agricultural value in Turkey.

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According to the district's Directorate of Agriculture, agricultural activities are carried out in 43 different regions, and 85 different types of crops are produced. The average value of production per decare in Gazipasa is higher than most of the other parts of Turkey because of the availability of fertile land, water and required climate. Despite this, the district may have a lower agricultural income than its potential due to the possible mistakes made in product selection. The aim of this study is to analyze the economic sustainability of existing crop production activities in the Gazipasa district of Turkey.

There are a number of examples in the literature that evaluate the economics of agricultural production for certain crop types. Gayak et al. (2020) consider the production and marketing of apple in a certain district of Nepal. Using the data from 100 farmers, they use statistical analysis to identify the factors that affect the production as well as the marketing of apples. They also conclude that apple farming has a 1.84 ratio of benefit over cost and thus profitable. Ugurlu (2019) uses survey data obtained from 82 producers to study to the economic evaluation of pomegranate production in Manisa province in Turkey. He finds that pomegranate production has a cost of 1950.4 TL per decare and a net profit of 834.5 TL per decare.

There are also studies conducted in the form of regional-based analysis of the agricultural sector. Uzunöz and Çiçek (2003) consider the effects of social and agricultural structure of agricultural enterprises on revenue generation in Kazova and Artova regions of Tokat province in Turkey. Their research includes the analysis of data obtained through a survey and the comparison of these two regions. They determine that the factors related to the agricultural structure of the regions have significant effects on agricultural income. Doğan and Gürler (2015) examine the supply sensitivity of products grown in the Yesilirmak basin in Turkey within the scope of agriculture support programs. They make recommendations on price, use of technology, and support policies. On a broader scope, Arun and Ghimire (2018) provide the strengths, weaknesses, opportunities, and threats for the Nepalese agriculture based on a national policy set in 2004.

Increasing operational costs in agricultural production makes the economic analysis of existing agricultural production even more important today than ever. Evaluating the profitability of current agricultural production in a certain region and making future estimates can be considered as useful approach that helps future planning. In this study, profit forecasts are made for the next 15 years based on the crop production in the Gazipasa district. Results will help identify the group of products that offer better economic returns. The next section explains the research methodology used.

Materials and Methods

Forecast studies are not new in the research area of agricultural production. Pandey et al (2008) use neural networks to forecast the production quantity of wheat for years 1996-2001. The inputs in their study are average rainfall, temperature and sunshine. Niyigaba and Peng (2020) forecast Rwanda's agricultural production in US dollars up until 2030. They use the grey model and ARIMA methods of forecasting with economics data obtained from National Institute of Statistics of Rwanda (NISR) and the World Bank dataset. Rana (2020) uses a fuzzy time series method with crop-yield data gathered from a university farm. He compares actual yield (kg/ha) with his forecast values to test the effectiveness of the model.

There are also studies that estimate crop profitability. McBride and Greene (2009) compare the prices and costs of conventional versus organic soybean production in order to evaluate the effect on profitability. Urfi et al. (2011) assess the similarities and differences between organic and conventional farming in Hungary in terms of costs and profits. They use data of agricultural business from two different regions and consider products that were cultivated both by organic and conventional means. In addition to unit yield, cost and price, they also include subsidies in profit calculations. Hrytsiuk and Babych (2017) study the profitability of grain production. Using two-year data of yield, price and costs, they use regression analysis and fuzzy simulation principles for predicting profits. Klima et al. (2020) access the impact of subsidies on the yield and profitability of a number of crop types cultivated in a mountainous region of Poland.

In this study, agricultural production's profit estimation for the next 15 years is made using time series analysis. The study consists of three phases which are picturing the current crop production, calculating current revenues, and making profit forecasts. Firstly, the current agricultural production is revealed by compiling the 2018 data from Farmer Registration System of district's Directorate of Agriculture. As a result of this stage, the types of products produced and the total decare where each type is cultivated are determined. Raw data included 85 different crop types cultivated in 43 different regions of Gazipasa. After extracting the data with zero production output, 81 different crop types and their cultivation areas are identified and listed in Table 1.

In all the tables following, the abbreviations GG, PG, TG, HTG and LTG refer to glass, plastic, tunnel, high tunnel and low tunnel greenhouse, respectively. Table 1 shows the size of the total land used for crop production in Gazipasa. It is seen that the most cultivated product is wheat with an area of 34000 decare (DA), followed by olives and banana.

In the second stage, the economic value of existing agricultural production is calculated by using the following formula:

$$TR_i = DA_i R_i P_i \qquad (1)$$

Where i is the index for crop type, $i = 1,\ldots,81$, and

TR_i : current total revenue for crop type i,

DA_i : total decar cultivated for crop type i,

R_i: harvest amount in kg for crop type i per decare,

P_i: current wholesale price for crop type i per kg.

In order to run Equation (1), data on the quantity produced per decare and the annual average sales price per kilogram for each type of product are collected from the district's Directorate of Agriculture. Based on that data, the current total revenue for each type of product was determined and a list was made according to annual turnover. As a result of the

listing, 30 products that make up 96.5% of the total turnover are determined. The last stage of the study continued with the cost and turnover values of the 30 products that generate the most revenue since the remaining 51 products' total economic value is assumed negligible.

In the last stage, profit calculations are made for the next 15 years based on the forecasts of prices and costs. It is predicted that both sales prices and operating costs will vary over time. For crop prices, linear trend projection is employed based on the actual prices per kilogram of the last 5 years using Equation (2) below.

$$P_{it}=a_i+b_i t \quad (2)$$

Where *t* is the time period in years, and

P_{it} : forecast of the wholesale-price per kg for crop type *i* in period *t,*

a_i : wholesale price at time zero (the y-intercept of the trend line) for crop type *i*,

b_i: slope of the trend line for crop type *i*.

In determining the annual operating costs per decare for each crop type, the current costs are first estimated by taking the expert opinion of 5 agricultural engineers and 7 producers present in the district. An annual average interest rate for agricultural support loans is then used to project the future rate of increase in operating costs. Future cost figures are thus estimated using the equation below.

$$v_{it} = v_{i0} (1+r)^t \quad (3)$$

Where *r* is the annual average interest rate for agricultural loans, and

v_{i0} : current operating cost per decare for crop type i, estimated by taking expert opinions,

v_{it} : estimation of the operating cost for crop type *i* per decare in year *t.*

Finally, the annual profit for each crop type is calculated using the area of the land planted, quantity produced per decare, forecast of the sales price per kilogram, and the estimation of the operating cost per decare. Equation (4) below is used for profit calculations.

$$TP_{it} = DA_i R_i P_{it} - DA_i v_{it} \quad (4)$$

Where TPit is assumed 0 if (4) returns negative, and

TPit : total profit for crop type i in year t.

Table 1. Gazipasa's crop production data in 2018.

#	Product	DA	#	Product	DA	#	Product	DA	#	Product	DA
1	Wheat	34.000	**22**	Eggplant GG	1.200	**43**	Jujube	385	**64**	Nectarine	110
2	Olive	20.000	**23**	Bean PG	1.200	**44**	Eggplant TG	380	**65**	Vetch type2	110
3	Banana	12.850	**24**	Eggplant PG	1.100	**45**	Carob	330	**66**	Pepper Capia PG	100
4	Cucumber GG	6.360	**25**	Orange Valencia	850	**46**	Pear	330	**67**	Watermelon GG	80
5	Strawberry HTG	6.175	**26**	Eggplant	850	**47**	Apple Golden	320	**68**	Cabbage	80
6	Almond	5.720	**27**	Peanut	800	**48**	Artichoke	310	**69**	Potato	70
7	Barley	4.800	**28**	Peach	770	**49**	Vetch type1	310	**70**	Pepper Pointed PG	60
8	Tomato GG	3.900	**29**	Green Pea	755	**50**	Pumpkin PG	290	**71**	Lettuce	60
9	Beans	3.700	**30**	Strawberry LTG	750	**51**	Apricot	280	**72**	Lemon	55
10	Triticale	3.550	**31**	Broad Bean	580	**52**	Tomato TG	270	**73**	Cauliflower	55
11	Banana PG	2.600	**32**	Pepper Pointed	560	**53**	Oat	260	**74**	Spinach	55
12	Cherry	2.400	**33**	Corn (Grain)	550	**54**	Kidney Bean Type 2	250	**75**	Okra	55
13	Bean GG	2.330	**34**	Plum	540	**55**	Chickpea	250	**76**	Mandarin Klamantin	35
14	Cucumber PG	2.220	**35**	Cucumber Tunnel	530	**56**	Peas (Dry)	230	**77**	Mulberry	30
15	Pomegranate	1.950	**36**	Orange Washington	500	**57**	Apple (Other)	210	**78**	Pepper Pointed GG	25
16	Tomato	1.500	**37**	Bean TG	500	**58**	Zucchini	190	**79**	Mandarin Satsuma	22
17	Onion	1.500	**38**	Kidney Bean	470	**59**	Strawberry	160	**80**	Apple Gransimit	20
18	Broad Bean	1.500	**39**	Rye	470	**60**	Kiwi	150	**81**	Quince	3
19	Walnut	1.400	**40**	Watermelon	460	**61**	Broccoli	150			
20	Avocado	1.240	**41**	Corn (Dent)	450	**62**	Stuffed Pepper	140		Total Land Cultivated: 141.550 decare	
21	Tomato PG	1.200	**42**	Grape	420	**63**	Pepper Capia GG	130			

Data obtained from Gazipasa Directorate of Agriculture.

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Results and Discussion

As the second phase of the study, the economic value of 81 different products grown in Gazipasa in 2018 is analyzed. Using Equation (1), total revenue in Turkish Lira for each type of product is calculated. After finding the revenues, all products are listed in descending order according to their returns and divided into groups for classification purposes. Results are presented in Table 2.

As seen in Table 2, the district achieved approximately 583 million TL agricultural revenue in 2018. Among all types of products, 30 that are in the first three groups generate 96.45% of the total revenue. The commercial return of the remaining 55 types of products remains very low at 3.55% of the total revenue. Therefore, it is assumed that these products are planted for hobby or trial purposes and hence are not included in the rest of the study. Table 3 provides the names and revenues of the top 30 products.

The top 10 products in Table 3 constitute 76.35 % of the total revenue of the district with a value of around 445.4 million TL. The total area planted for these products is 59,765 decare. This amount corresponds to 42.22% of the total agricultural production area of Gazipasa. Open field banana, cucumber grown in glass greenhouse, tomato grown in glass greenhouse, and banana grown in plastic greenhouse are the top four revenue generating products with an annual return of at least 50 million TL.

The second 10 products make up 14.99% of the total revenue with an annual return of around 87.4 million TL. Although their yields are far behind compared to the top ten products, this group includes products with high long-term yield potential such as avocado, pomegranate, cherry, walnuts and almond. This group of products constitutes 38.36% of the total cultivated land. Almond, which has a harvest time of around 7 years after plantation, is the on the top of the list. Plastic greenhouse tomato and bean take the second and third place respectively. Avocado, which has been commercially produced in the district for the last 6 years only, ranks seventh.

The last 10 products in Table 3 constitute 5.1 % of the total revenue with a return of around 29.8 million TL and occupies 3.34% of the total cultivated area. Excluding orange-valancia and peaches, the remaining eight in this group are high tonnage products in the district and can be yielded in the same season. This shows that although these products do not bring as much income as the ones in the first and second ten, they have a potential for future.

Table 2. Groups of products according to generated revenue.

Groups	1st Ten	2nd Ten	3rd Ten	4th Ten	5th Ten	Rest 51-81	TOTAL
Total Revenue (Million TL)	445.41	87.44	29.79	10.90	5.34	4.49	583.37
% Share	76.35	14.99	5.11	1.87	0.92	0.76	100

Table 3. Top 30 revenue generating products.

#	Product Name	Revenue (TL)	#	Product Name	Revenue (TL)	#	Product Name	Revenue (TL)
1	Banana	100,230,000	11	Almond	14,157,000	21	Strawberry LTG	3,952,500
2	Cucumber GG	84,588,000	12	Tomato PG	13,680,000	22	Cucumber TG	3,524,500
3	Tomato GG	51,870,000	13	Bean PG	11,520,000	23	Eggplant TG	3,458,000
4	Banana PG	50,544,000	14	Pomegranate	9,630,150	24	Peach	3,368,750
5	Strawberry HTG	36,741,250	15	Cherry	8,880,000	25	Pepper Capia GG	3,328,000
6	Bean GG	27,960,000	16	Wheat	7,514,000	26	Bean TG	3,000,000
7	Cucumber PG	25,308,000	17	Avocado	6,820,000	27	Watermelon	2,622,000
8	Olive	24,750,000	18	Tomato	5,700,000	28	Orange Valencia	2,244,000
9	Eggplant GG	23,400,000	19	Beans	4,921,000	29	Pepper Capia PG	2,240,000
10	Eggplant PG	20,020,000	20	Walnut	4,620,000	30	Tomato TG	2,052,000
	TOTAL	445,411,250		TOTAL	87,442,150		TOTAL	29,789,750

Considering all the products in Table 3, greenhouse production seems to be very important for generating district's revenues. Excluding banana and strawberry, greenhouse production includes vegetables only. Among those, cucumber provides the highest yield, followed by tomato and eggplant. Table 3 also shows that return on field vegetables produced in Gazipasa are not very high. There are three products that stand out in terms of revenue generated from field vegetables and these are tomato, beans and watermelon in sequence.

For any product that has an economic value, profit can be calculated as revenue minus cost. In this part of the study, profits for the 30 types of products listed in Table 3 are calculated using unit prices, yields, and costs. Based on the data gathered, highest yields are eggplant-glass greenhouse with 15 tons/decare, followed by cucumber-glass greenhouse, tomato-glass greenhouse, and eggplant-plastic greenhouse each with 14 tons/decare. The lowest yields per decare are wheat with 0.26 tons, walnuts with 0.30 tons, almond with 0.45 tons, and olives

with 0.83 tons. In general, yield per decare for greenhouse products is high whereas it is low for fruits produced from trees that do not require an irrigation system.

The third phase of the study is forecasting the profitability in future years. First, as in Equation (2), linear trend projection is employed for each of the 30 crop types to predict future prices using the wholesale-price data of the last 5 years. Results for selected product types are depicted in Figure 1 where the 6th time period refers to year 2020. MS Excel's function of adding a trend line and equation was used in the graphs.

In terms of costs, the current operating cost for each crop type is determined by taking the expert opinion. The average annual agricultural loan interest rate of 7.5 % is then used to increase the costs annually as in Equation (3). Results for selected crop types are shown in Figure 2.

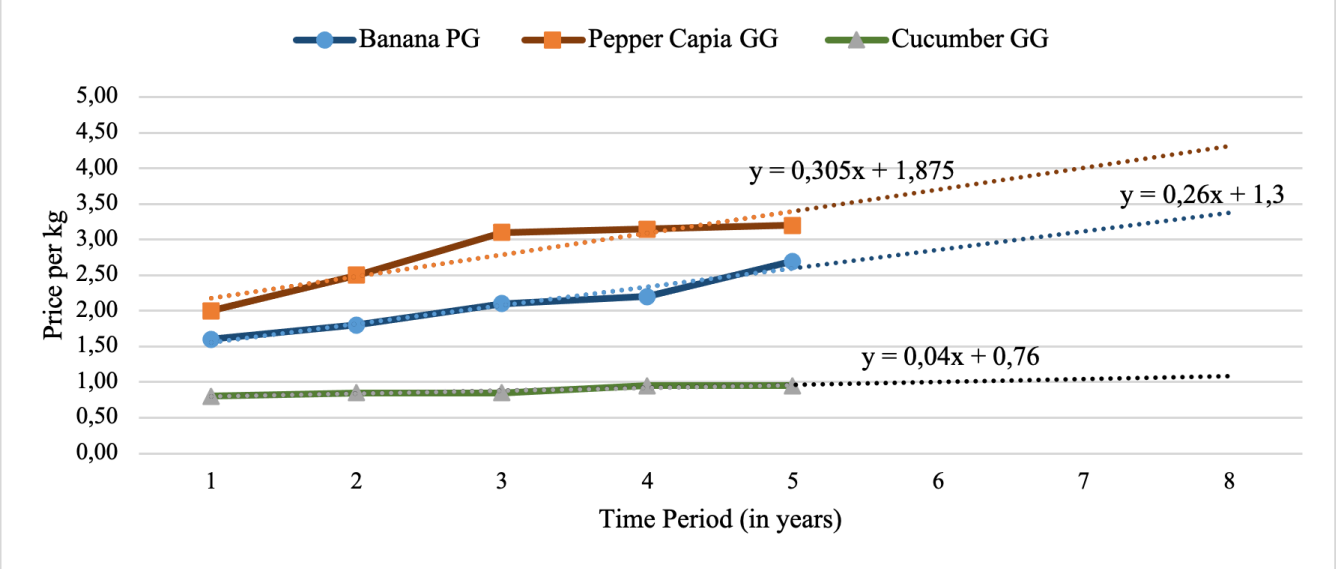

Figure 1. Linear trend projection for selected crop types

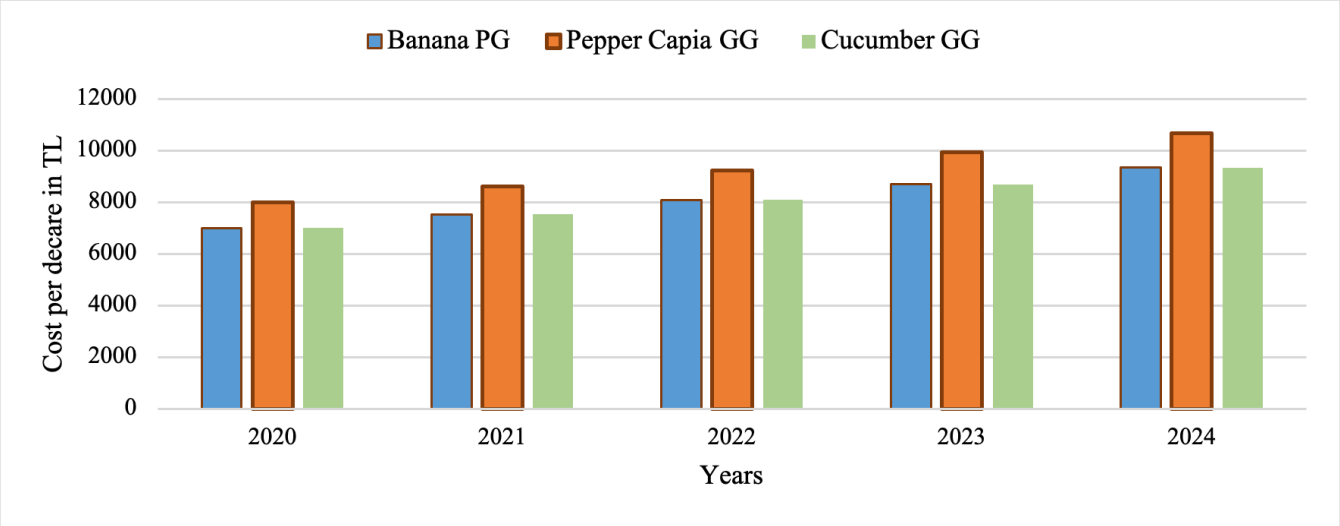

Figure 2. Estimated operating costs over years for selected crop types

Yield per decare for a product type is assumed constant over years. The total profit for each crop type in each of the next 15 years is then calculated using Equation (4). Results are presented in Table 4 where Year 1 refers to 2020. The first column of Table 4 represents the 30 most revenue generating products named in Table 3 where the column DA indicates the total decare of the cultivated land. Remaining columns show the profits per year in million TL for years from 1 to 15.

The last row of Table 4 shows the total profit for the next 15 years if the current agricultural production does not change. It is seen that the annual total profit, which is around 298 million TL in the first year, gradually increases to around 385 million TL in the 11th year and then starts to decrease. Aggregated values for the timespans of 1, 5, 10 and 15 years are given in Table 5. The table shows, in case the current planting scheme continues, the total profit generated, annual average profit, the total area of land cultivated and its percentage compared to total arable land for each of these timespans.

Table 4. Total estimated profit per year for the next 15 years for each crop type (Million TL).

#	DA	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
1	12800	37.95	41.41	44.50	47.21	49.51	51.35	52.72	53.56	53.86	53.55	52.61	50.97	48.59	45.41	41.38
2	6360	44.52	44.74	44.71	44.42	43.83	42.93	41.70	40.11	38.13	35.74	32.90	29.58	25.74	21.35	16.36
3	3900	28.39	29.07	29.60	29.97	30.15	30.15	29.94	29.51	28.84	27.92	26.73	25.24	23.43	21.28	18.77
4	2600	33.85	37.22	40.48	43.64	46.67	49.58	52.36	54.98	57.45	59.75	61.86	63.78	65.49	66.97	68.21
5	6175	7.81	7.44	6.90	6.17	5.23	4.09	2.71	1.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	2330	17.59	19.51	21.34	23.08	24.70	26.21	27.60	28.86	29.98	30.94	31.74	32.37	32.80	33.03	33.05
7	2220	11.10	11.00	10.81	10.53	10.15	9.66	9.05	8.32	7.45	6.44	5.27	3.93	2.41	0.70	0.00
8	20000	17.70	18.45	19.13	19.74	20.27	20.72	21.08	21.34	21.50	21.54	21.47	21.26	20.92	20.43	19.77
9	1200	16.98	18.15	19.27	20.34	21.36	22.32	23.22	24.04	24.80	25.48	26.07	26.57	26.97	27.27	27.46
10	1100	14.01	14.98	15.90	16.77	17.59	18.36	19.07	19.72	20.30	20.81	21.24	21.59	21.85	22.02	22.08
11	5720	11.04	11.60	12.14	12.66	13.17	13.65	14.12	14.56	14.98	15.37	15.73	16.06	16.35	16.62	16.84
12	1200	6.29	6.38	6.42	6.41	6.35	6.23	6.04	5.79	5.47	5.06	4.58	4.00	3.32	2.54	1.65
13	1200	5.57	6.23	6.85	7.42	7.93	8.39	8.78	9.10	9.35	9.53	9.62	9.61	9.51	9.31	8.99
14	1950	8.11	8.26	8.39	8.52	8.63	8.73	8.81	8.87	8.92	8.96	8.97	8.96	8.93	8.87	8.79
15	2400	4.94	5.59	6.21	6.81	7.38	7.94	8.46	8.96	9.42	9.85	10.24	10.60	10.91	11.18	11.40
16	34000	2.81	2.56	2.28	1.97	1.63	1.25	0.84	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	1240	4.26	5.16	6.05	6.93	7.79	8.63	9.46	10.26	11.04	11.80	12.54	13.25	13.93	14.57	15.19
18	1500	2.55	2.75	2.93	3.08	3.21	3.32	3.39	3.44	3.45	3.43	3.37	3.27	3.13	2.94	2.70
19	3700	0.37	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	1400	4.02	4.33	4.64	4.94	5.23	5.51	5.78	6.04	6.28	6.51	6.73	6.94	7.12	7.29	7.44
21	750	1.16	1.15	1.11	1.06	0.99	0.90	0.79	0.65	0.49	0.29	0.07	0.00	0.00	0.00	0.00
22	530	1.59	1.58	1.56	1.52	1.47	1.41	1.33	1.23	1.12	0.98	0.82	0.65	0.44	0.21	0.00
23	380	1.09	1.16	1.21	1.24	1.26	1.26	1.24	1.20	1.13	1.04	0.93	0.78	0.61	0.40	0.15
24	770	3.44	3.93	4.41	4.88	5.36	5.83	6.31	6.77	7.24	7.70	8.15	8.61	9.05	9.50	9.94
25	130	3.15	3.53	3.91	4.28	4.65	5.01	5.36	5.70	6.03	6.36	6.67	6.97	7.26	7.54	7.80
26	500	0.14	0.21	0.27	0.30	0.31	0.30	0.26	0.19	0.10	0.00	0.00	0.00	0.00	0.00	0.00
27	460	3.61	4.23	4.84	5.45	6.05	6.65	7.25	7.85	8.44	9.03	9.61	10.19	10.76	11.33	11.89
28	850	1.49	1.58	1.67	1.75	1.82	1.89	1.96	2.01	2.06	2.10	2.13	2.16	2.17	2.17	2.16
29	100	2.12	2.38	2.63	2.88	3.13	3.37	3.61	3.84	4.06	4.28	4.49	4.69	4.89	5.07	5.25
30	270	0.31	0.28	0.24	0.18	0.11	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
∑	117735	297.97	314.92	330.41	344.16	355.97	365.68	373.21	378.37	381.89	384.46	384.53	382.01	376.60	368.01	357.27

Table 5. Aggregated profit figures and land usage in future years.

	Total Profit (TL)	Average Annual Profit (TL)	Total Cultivated Land (Decar)	Arable Land Usage (%)
Year 1	297,974,060	297,974,060	117,735	%83.18
Year 5	1,643,447,113	328,689,423	114,035	%80.56
Year 10	3,527,064,507	352,706,451	73,090	%51.64
Year 15	5,395,483,530	359,698,902	69,590	%49.16

As can be observed in Table 5, the total area of land currently cultivated and hence the percentage of arable land used are decreasing over years. At the end of the first year, economic return is obtained from 117,735 decares of the potential 141,550 decares, and approximately 17 % of the arable land remains idle. In case the current agricultural crop diversity continues, the rate of idle land increases in the following years as the production of some crop types will cease. Although the total annual profit decreases after the 11th year, the average annual profit keeps increasing due to the rising prices of crops that continue to be produced in the future years. Production sustainability of the crop types based on the profits they generate is summarized in Table 6.

Table 6. Production sustainability of existing crop types based on profitability.

	Production Stops	Profitability Decreases	Profitability Increases	
Product Name & Number	Strawberry HTG (# 5)	Cucumber GG (# 2)	Banana (# 1)	Cherry (# 15)
	Cucumber PG (# 7)	Tomato GG (# 3)	Banana PG (# 4)	Avocado (# 17)
	Wheat (# 16)	Tomato PG (# 12)	Bean GG (# 6)	Tomato (# 18)
	Bean (# 19)	Eggplant TG (# 23)	Olive (# 8)	Walnut (# 20)
	Strawberry LTG (# 21)		Eggplant GG (# 9)	Peach (# 24)
	Cucumber TG (# 22)		Eggplant PG (# 10)	Pepper Capia GG (# 25)
	Bean TG (# 26)		Almond (# 11)	Watermelon (# 27)
	Tomato TG (# 30)		Bean PG (# 13)	Orange Valencia (# 28)
			Pomegranate (# 14)	Pepper Capia PG (# 29)
Total Count	8	4		18

Table 6 shows that only 18 out of 30 types of products remain profitable over years. On the other hand, the cultivation of 8 types of products will need to be ended after some years. For example, the profitability of bean and bean-tunnel greenhouse will be zero after 2 and 9 years respectively, and hence their production will stop accordingly. Moreover, there are four types of products whose profit decrease continuously even if not stopped indicating that their production will also cease sometime after 15 years.

A profit greater than zero doesn't necessarily mean sufficient rate of return is achieved. In order to calculate the return on investment, land setup costs for plantation is estimated by taking expert opinion. It is found that the total current setup cost of the agricultural production for the 30 types of products considered is approximately 2 billion TL. Since the total profit in the first year is approximately 298 million TL, return on investment in the first year is 14.9 %. As the planning period in the study is 15 years, internal rate of return (IRR) is also calculated. IRR is the rate that makes the net present value of all cash flows equal to zero. Setting 2 billion TL as the initial investment and the total profits in Table 4 as net cash flows, IRR is found to be 15 %. Current interest rate in the Turkish financial markets is above 16%, and the policy interest rate set by the Central Bank of Turkish Republic is above 17%. Hence, the IRR found is considered to be low compared to the annual return of alternative investment instruments in financial markets. In order to increase it, a better agricultural planning is required in Gazipasa. That plan should take into account the future profitability while selecting crop diversity in the district.

Continuing with the plantation of the 18 profit-making products in Table 6 in all arable land does not necessarily mean that optimal plan is achieved. Each product type may require different soil characteristics, land sizes, climate, and irrigation. Future cultivation planning should also consider these exterior factors.

Conclusion

In this study, the economic analysis of the agricultural crop production of Turkey's Gazipasa district for the next 15 years was made. Out of 81 different products currently grown in 43 regions of the district, 30 products with the highest revenues were determined. Current total return of these products corresponds to 96.45 % of the total revenue and covers 83.18% of the existing agricultural areas. Total income and expenses were determined for those 30 types of products and the profitability was forecasted on a yearly basis. It was found that the total profit increases slowly in the next 11 years and then decreases. It was observed that the profits achieved would increase for only 18 out of 30 product types. Results show that such analysis may help shape future plans in agriculture in order to increase profitability and maintain economically sustainable production. Conducting similar studies on different regions of the country and coordinating their results may also be useful to identify production policies on a national basis. Future studies can also include identifying the optimal product types for a certain region with taking into consideration the factors affecting agricultural production.

Compliance with Ethical Standards

Conflict of interest

The authors declared that for this research article, they have no actual, potential or perceived conflict of interest.

Author contribution

The contribution of the authors to the present study is equal. All the authors read and approved the final manuscript. All the authors verify that the Text, Figures, and Tables are original and that they have not been published before.

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