Comparative profitability and productivity analysis in dwarf pear production in Turkey: case of Bursa Province

Reception of originals: 05/18/2018
Release for publication: 03/18/2019

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Abstract

This study includes the dwarf pear farms which apply and do not apply good agricultural practices in Bursa Province of Turkey. The basic purpose of this study was to make the economical comparison of the enterprises which applied and did not apply good agricultural practices in terms of productivity and profitability. Total of 22 dwarf pear producers who applied good agricultural practices were interviewed and data were gathered by using questionnaire method in Bursa province. In the same provinces, the same survey was also conducted with the same number of producers which did not apply good agricultural practices. When good agriculture practices subsidy amount was added, total production costs, gross production value, gross profit, net profit and breakeven point per hectare were

determined to be respectively as 24916.67 $, 28114.16 $, 14080.07 $, 3197.49 $ and 38864 kg in the enterprises which applied good agricultural practices. The same indicators were determined to be respectively as 26758.16 $, 28620 $, 12839.08 $, 1861.84 $ and 45738.50 kg in the enterprises which did not apply good agricultural practices. Gross labor productivity, net labor productivity, gross capital productivity, net capital productivity, gross factor productivity and net factor productivity were calculated as 8.67 $, 0.99 $, 0.57 $, 0.06 $, 1.13 $ and 0.13 $, respectively in pear farming by applying good agricultural practices whereas they were determined as 3.98 $, 0.26 $, 0.56 $, 0.04 $, 1.07 $ and 0.07 $ in pear farming by not applying good agricultural practices. According to the results, dwarf pear farming was determined to be more profitable in the enterprises which applied good agricultural practices.

Keywords: Dwarf Pear, Productivity, Profitability

1. Introduction

Pear is cultivated almost everywhere which the apple culture expands in the World. Nevertheless, pear can be cultivated economically in the warm climate regions of Mediterranean as it is less sensitive to heat and drought when compared with apples. Chinese, Italy and the United States of America are the most significant countries in pear production in the World. Turkey takes the fourth rank in pear production in terms of area. According to the last statistics, approximately 463623 tons of pear production exists in Turkey. Turkey takes the sixth rank in pear production in the World (Anonymous, 2018a).

Pome fruits such as apple, pear and quince constitute approximately one fifth of total fruit production in Turkey and 18% of this production is pear. Bursa province comes first in pear production in Turkey (Anonymous, 2018b). Approximately, 34% of total pear production in Turkey occurs in Bursa province.

Obtainment of earlier yields and usage of more trees per unit area are the characteristics of dwarf rootstocks. Providing the return of the investment in earlier years can be possible by using dwarf rootstocks. Although the initial costs are a bit more due to the usage of large number of trees per hectare in the dwarf pear orchards established with dwarf pear trees, providing the return of this cost can be possible in a short time according to the other high growing rootstocks by the obtainment of yield in the following year.

Application of pesticides to the dwarf pear orchards are easier and more economic according to the high growing rootstocks because the application of pesticides to the big trees necessitate more attention, more time and usage of more powerful machines. Pruning by chemical and hand thinning in dwarf pear orchards is easier and more economic as seen in the application of pesticide. The required human labor amount in all kinds of cultural applications

considerably decrease. The other advantage in dwarf trees is less mechanical damage possibility during harvest as the fruit harvest is easier and cheaper and thus, stairs usage is not required.

Keeping the old and big trees in the orchard is not profitable and removing these form the orchard is difficult and expensive. The general opinion of the farmers is that yield is obtained from the high growing trees in 6-10 years and these trees stay in yield for 15-20 years and complete their economic life in 25-30 years. In other words, as these trees complete their economic life in 25-30 years, planting new trees instead of these takes 25-30 years. As yield is obtained shortly after the planting from the dwarf trees and the dwarf trees return to profitability in the early years and removing these trees is easy, yield is obtained sooner from the re-planted kinds. Due to these characteristic of dwarf orchards, a kind which is not appeal due to the marketing demands can be changed with a more attractive kind in a short time.

Determination of the input usage amounts, costs and incomes of agricultural products is vital in terms of the producers and agricultural economics policy makers. The results of the researches related with agricultural crop costs are very significant for the governments to determine the pricing policies. Besides, agricultural crop costs are commonly used for the determination of the usage levels of physical production inputs, labor planning, performing the financing programs and preparing the crop budgets (Anonymous, 2001).

The benefits at a level of an enterprise can be stated as determining the resource requirement of the production activities in detail, determining and analyzing the profitability of the different activities in the enterprise, determining the reasons of the variations in the production cost, determining the administration norms for different enterprise types and sizes, determining the enterprise organization and optimum input requirement for the production activities, composing appropriate marketing policy and strategies and composing data base for the investment projects and various long term studies (Yılmaz and Yılmaz, 1999; Özkan and Yılmaz, 1999).

Several research studies were conducted on economic analysis and profitability of fruit production. Demircan et al. (2005) determined the cost and return of apple production in Isparta province in Turkey. The results showed that usage of labor and machinery were 103.61 and 5.61 h da^{-1} in production period, respectively. The establishment and production costs were 1361.44 and 776.98 YTL da^{-1}, respectively. Gross profit, net profit and relative return were found to be 699.94, 486.79 YTL da^{-1}, 1.63, respectively. Yaşasın et al. (2005) aimed to analyze different planting space for two apple varieties. Trials were

composed of two sub-projects. In the first sub-project, single, double and triple rows planting systems were compared in apple cvs. Granny Smith and Gloster 69 on M9. In the second sub-project, 4x2m, 4x3m and 4x4m planting spacing were evaluated in apple cvs. Starkrimson Delicious and Starkspur Golden Delicious on MM 106. Gross and net incomes were also calculated. The 4x2m combination gave the best results compared with classic planting system for cumulative yield, average yield, total net income, average net income/year in two cultivars. Gündoğmuş (2006) determined the profitability in apricot production on organic and conventional farms in Turkey. It was determined that the cost of production per hectare on organic farms was 2% less than that on conventional farms, and the gross product value and net income were 3% less than on conventional farms. Aydoğmuş and Yılmaz (2010) aimed to analyze input use, profitability and productiveness in apple production using dwarf rootstock (M9), semi- dwarf rootstock and seedling in Elmali County where more than 2/3 of apple production of Antalya is obtained.

Productivity analyzes showed that, in apple production using dwarf rootstock, not only land productivity but also labor productivity and capital productivity increased although more labor and capital is required. Total factor productivity showed that for 1 TL cost in apple production, the net return in enterprises for dwarf rootstock, semi- dwarf rootstock and seedling were 0.77, 0.05 and 0.012 TL, respectively. Mohammadi et al. (2010) determined the cost analysis of kiwifruit production in Iran. The results showed that total cost of kiwifruit production was obtained as 6063.81 \$ ha^{-1}. The productivity (4.05 kg $\$^{-1}$) was obtained by dividing kiwifruit yield by total production cost. Loghmanpor et al. (2013) determined the economic analysis of strawberry production in Bablosar zone of Iran. The profit/cost ratio, productivity and net profit in the strawberry production were 1.37, 1.1 kg $\$^{-1}$ and 2333.4 \$ ha^{-1}.

Özalp and Yılmaz (2013) aimed to make the economic analysis of pomegranate production in Antalya province. As a result of the study the average production cost was found 13 822.7 TL ha^{-1}. Realization of this production cost resulted with 19 696.8 kg ha^{-1} yield. The average gross margin and net return in the investigated enterprises were 10 841.2 TL ha^{-1} and 3 116.6 TL ha^{-1} respectively. Total factor productivity data showed that for 1 TL production cost in pomegranate production, the net return in enterprises was 0.23. QasemiKordkheili et al. (2013) investigated the economic analysis of nectarine production in sari region of Iran. The benefit-cost ratio was found to be 16.74. Economic analysis showed that the total cost of production was 0.056 \$ kg^{-1}. Also, the mean expenditure for the

production was 1638 $ ha^{-1}. Aydın et al. (2017) determined the economical comparison of the enterprises applying and not applying good agricultural practices in Thrace Region of Turkey.

According to the results, the cost of producing; one kg of pear was calculated 1.11 TL in the enterprises which applied good agriculture while it was calculated 1.12 TL at the enterprises which did not apply the good agriculture. Total expenses, gross output value, gross profit, net profit and relative profit were determined to be respectively as 16682.80 TL, 24250 TL, 14938.10 TL, 7567.20 TL and 1.45 in the enterprises applying good agricultural practices. Total expenses, gross output value, gross profit, net profit and relative profit were determined to be respectively as 15652 TL, 21000 TL, 11511.80 TL, 5348 TL and 1.34 in the enterprises not applying good agricultural practices. According to economic analysis results, pear farming was determined to be more advantageous in the enterprises applying good agricultural practices. Baran et al. (2017) investigated the economic analysis of walnut production in Central Anatolian Region in Turkey. According to the results, the benefit cost ratio was calculated as 1.88 and the net return from walnut production in the surveyed farms was at a satisfying level. Kanat et al. (2017) determined the production costs of dwarf and semi-dwarf Granny Smith apple in Konya province.

According to the results of the research, the establishment cost was 2445.56 TL da^{-1}, labor request was 95.14 h da^{-1}, the machinery and tractor requests were calculated 6.13 h da^{-1}, and the production costs were estimated 697.44 TL on semi-dwarf apple orchards. The establishment cost was 3342.97 TL da^{-1}, labor request vas 129.30 h da^{-1}, the machinery and tractor requests were calculated 6.32 h da^{-1}, and the production costs were estimated 806.88 TL on dwarf apple orchards. Gross profit, net profit and relative profit were found to be 1253.15 TL da^{-1}, 973.76 TL da^{-1}, 2.21 respectively on dwarf apple orchards. Gross profit, net profit and relative profit were found to be 651.56 TL da^{-1}, 396.67TL da^{-1} and 1.56 respectively on semi-dwarf apple orchards. Yılmaz et al. (2017) aimed to calculate the production cost, gross production value, gross profit, absolute profit and relative profit in farms which implemented or did not implement good agricultural practices in citrus cultivating in Adana.

The relative profit in GAP implementing farms involved in lemon cultivating was 1.15 while it was 1.22 in farms which did not implement good agricultural practices; and it was 1.19 in mandarin cultivating farms which implemented and did not implement good agricultural practices. It was found out that the citrus cultivating was profitable in both forms of cultivating. The reasons why profitability was higher in farms which did not implement

good agricultural practices were productivity, sales price and additional costs of implementing good agricultural practices.

In this study, it was aimed to make the comparative cost, profitability and productivity analysis in pear production by applying and not applying good agricultural practices in Bursa province of Turkey.

2. Profitability Concept

The aim of an enterprise, carrying out an economic activity, is to obtain the highest profit with least expense. The enterprises determine the benefit or the incomes and calculate the costs of the crops in order to achieve this. A great majority of the agricultural enterprises in our country do not keep the accounting records of the activities. For this reason, determination of the incomes of the agricultural enterprises and consequently planning of the production activities is very difficult. Besides, the current structures of the agricultural enterprises should be considered, all of the details in production process should be presented and effectiveness of the sources should be determined in order to analyze the problems in agricultural production and take precautions for increasing the productivity.

The different meanings of profitability could be as numerous as the number of researchers conducting studies on profitability. “Profit” is generally one of the most common and accepted indicators for the success of an economic activity (Offermann and Nieberg, 2000).

Besides, profitability may be defined as the expression of the result obtained by the organization as a result of an activity of transformation/exchange (Pavaloaia et al. 2010). The profitability is the main part of the economic and financial mechanism, reflecting the leverage of available sources. The farm profitability reflects the measuring of effects materialized in revenues with the efforts involved materialized in expenditure. Profitability is obviously related not only to costs of production but also to revenue.

Profitability can be defined in several ways, such as the difference between revenue and costs (gross margin) or the ratio between cost and revenue. The profitability of the farms is a form of expression of economic efficiency, including a number of key economic and financial aspects of an organization, as a relevant indicator for decision making and its orientation options (Burja, 2008). The profitability can be expressed using two categories of indicators; profit and rates of return. The profit reflects the absolute size of the profitability

and rates of return refers to the degree to which capital and resource generate profit (Infanescu et al. 2002).

The rate of return as an indicator, can take different forms, as consider gross profit or net profit. The rate of return is a relative measure that expresses the degree to which capital as a whole generates profit. Economic rate of return measures the performance of the total assets without consider the way of acquire the capital allocated for the construction of the asset. For this reason it is said that the economic rate of return is independent by the funding policy promoted by the organization (Buglea, 2011).

3. Good Agricultural Practices Concept

Control and certification applications for quality management under the concepts such as “EurepGap”, “GAP” and “Geographical Marking” gradually increase and vary in production and marketing services of horticultural crops and processed food sector. International consumer demands and national/international regulations differ according to the agricultural structures of the countries and necessitate this certification chain in terms of the agricultural crops (Pezikoğlu, 2008). Certification includes the indispensable “traceability” process for food security.

Since the sustainable development has been revealed, the subject has been more environment and ecology oriented. The most significant impulsion is consumer welded for reaching to this consideration. This case has revived the concepts such as “from fork to the farm”, “food security” and consumers have begun to search these criteria on the food. Quality management systems and traceability have reached to the agricultural production and the farm by World Trade Organization (WTO) which provides the commercial liberty in the agriculture. Quality management systems such as HACCP which is used by the industry in food production have revealed the similar studies for the agricultural products qualified as raw materials.

These developments in the World are relayed to the producers by the crop providers. All of the actors in the production phase require different production and marketing strategies in order to provide added value increase and maintain its existence against this development. One of these developments is Good Agricultural Practices (GAP). Adoption of the system by the producers is vital in terms of the “green consumer” demand in the domestic market and the sustainability of the exportation.

The import tax restrictions as a result of World Trade Organization lead to the nontariff barriers. A great majority of the nontariff barriers disappear for the crops which are produced according to the production systems such as Good Agricultural Practices, Organic Farming etc.

Good agricultural practices can be defined as a system which has the instructions and the standards which will provide the secure production of the agricultural crops (Duman et al. 2004). Traceability is essential in this system. The first regulation of GAP in Turkey was published in 2004 and previously, it was defined as EurepGap as it was aimed at the retail recipients in European countries. The regulations altered in different dates and finally it was published in the 7 December 2010 dated and 27778 numbered Official Gazette. According to the regulations, GAP is defined as the practices that are required to make agricultural production system socially sustainable, economically profitable and productive and to protect human health and environment.

The subsidies which will be given to the eco-friendly productions exist in the supporting which can be given to the producers in the agriculture by World Trade Organization and good agricultural practices is considered as one of these systems. The producers should be registered to Farmer Registration System and should be certificated in order to utilize from good agricultural practices production subsidies.

Good agricultural practices subsidies are provided to open-field fruit-vegetable production and greenhouse production (fruit-vegetable-ornamental plants) and vegetative production material. Good agricultural practices is accepted by the exporter producers as it composes a significant product differentiation in exportation. As the domestic market is not sufficiently matured, the production continues on a significant level in spite of the legislative alignment, projects and support payments which have been performed within years.

Good Agricultural Practices is a quality management system which includes the standards providing the food security, environment, human and animal health. For this purpose, it has standards under the following three main topics.

- Food security and quality (food which does not affect the human health negatively)
- Environment security and health (soil, water, plant and animal health and security)
- Social responsibility (worker health, working area health and sufficient income)

Good agricultural practices production area in Turkey was 5361 ha in 2007 and it reached to 474107 ha in 2016. These numbers were 107 ha and 1870 ha in Bursa province respectively. Total of GAP pear production area was 1168 ha in 2015 (Anonymous, 2018c).

4. Materials and Methods

The main material of the study is the survey data which was done with the dwarf pear producers in Bursa province of Turkey. In the study, total of 22 pear producers who applied good agricultural practices in Bursa province participated in the survey. Besides, the same survey was also conducted with the same number of producers who did not apply good agricultural practices for the comparison of the enterprises.

The fruit kind and the region conditions are generally effective for the determination of the facility period in fruit growing. In this study, the facility period was taken as 2 years. The facility costs consist of labor and machinery costs, seedling, fertilizer, pesticides, water expenses, general administration expenses and interest on bare land value. Current and compound interests of the total costs during the facility period were calculated and composed the facility period interest. 3% of the total variable cost was considered as general administrative expenses. The interest of bare land value was calculated by taking 5% of the current trading value of bare land in the region (Kıral et al. 1999). 5% of the facility costs were added to the expenses as investment compound interest.

Total production costs were determined and they were classified as variable and fixed costs. The variable costs consist of fertilizer expenses, pesticides, netting, labour costs, machinery costs, water fee, crop insurance, repair and maintenance expenses and revolving interest. The revolving interest was calculated by subjecting half of the interest rate (5%) applied to the vegetable production loans by T.C. Ziraat Bank (Kıral et al. 1999). The certification and analysis fees were taken as variable costs in the products produced with good agricultural practices. The drug store, medicine cabinets, firefighting equipment, mask, glasses, gloves, pallets, metal drums, dispensing unit, first aid box, toilet and so on, which were mandatory for production with good agricultural practices, were added to the amortization share of the facility costs in fixed costs by calculating the annual amortization shares.

General administration expenses, interest on bare land value, irrigation machine-tool depreciation and interest, facility costs depreciation and garden foundation interest were taken

as fixed costs. 3% of the total variable cost was considered as general administrative expenses (Kıral et al. 1999). The facility costs depreciation was calculated by dividing the total facility costs (2 years) to the economic life of the orchard (25 years). Garden foundation interest was calculated by implementing 5% interest to the half of total facility costs.

Gross production value was calculated by multiplying the yield and selling price. Good agriculture practices subsidies were added to the gross production value of pear production by good agricultural practices. Gross profit was calculated by subtracting the variable costs from gross production value and net profit was calculated by subtracting the total costs from gross production value.

Gross profit = Gross production value - Variable cost,

Absolute Profit = Gross production value - Production cost

(Açıl and Demirci, 1984; Kıral et al. 1999; Tanrıvermiş, 2000).

The production level in breakeven point was calculated. The breakeven point is the point in which the total income is equalized to the total cost (Mazhin, 1987). In this study, breakeven was calculated in terms of amount.

Breakeven point = Fixed costs / (selling price – unit variable costs)

Productivity is defined as output per unit input in a certain period. Total factor productivity was calculated by dividing the total output to the total inputs (Sadoulet and Janury, 1995).

TFP (gross or net) = Output (GPV or net profit) / total production costs

5. Results and Discussion

5.1. Facility costs

Average facility costs of dwarf pear orchards per unit area are given in Table 1. Total facility costs of pear production in the enterprises which applied good agricultural practices were determined as 49763.38 $ ha^{-1}. Total variable costs and fixed costs were found as 31273.53 $ ha^{-1} (62.84%) and 18489.85 $ ha^{-1} (37.16%), respectively. The most significant item of facility costs was irrigation facility (34.41%) and bare land value interest (28.45%) followed this. As seen in Table 1, 73.66% of total facility costs occurred in the first year and 26.34% of total facility costs occurred in the second year.

Total facility costs were found as 50722.56 $ ha^{-1} in the enterprises which did not apply good agricultural practices and 60.73% of the total facility costs were variable costs

(30803.41 $ ha^{-1}) and 39.27% of the total facility costs were fixed costs (19919.15 $ ha^{-1}). The most significant item of facility costs was irrigation facility (33.76%) and bare land value interest (30.83%) was the second highest cost item. As seen in Table 1, 71.59% of total facility costs occurred in the first year whereas 28.41% of total facility costs occurred in the second year.

Table 1: Facility costs in dwarf pear production ($ ha^{-1})

Cost items	GAP				Non GAP			
	1.year	2. year	Total	%	1.year	2. year	Total	%
Deep ploughing	19.09	0.00	19.09	0.04	12.01	0.00	12.01	0.02
Ploughing	25.71	25.71	51.42	0.10	10.78	12.01	22.79	0.04
Fertilizing	1720.27	373.24	2093.51	4.21	1720.27	373.24	2093.51	4.13
Spraying	1015.07	1015.30	2030.37	4.08	1042.69	1042.69	2085.39	4.11
Planting point marking + planting + irrigation	379.50	0.00	379.50	0.76	379.50	0.00	379.50	0.75
Stake planting and tying	45.80	0.00	45.80	0.09	45.80	0.00	45.80	0.09
Irrigation	2723.61	416.53	3140.14	6.31	3091.74	328.04	3419.77	6.74
Irrigation facility	17123.29	0.00	17123.29	34.41	17123.29	0.00	17123.29	33.76
Pruning and floor cleaning	336.03	1065.48	1401.51	2.82	336.03	1065.48	1401.51	2.76
Diesel fuel	653.88	653.88	1307.76	2.63	653.88	653.88	1307.76	2.58
Seedling	3343.38	337.76	3681.14	7.40	2652.97	259.13	2912.10	5.74
Variable costs	***27385.63***	***3887.90***	***31273.53***	***62.84***	***27068.95***	***3734.47***	***30803.41***	***60.73***
General administration expenses	821.57	116.64	938.21	1.89	812.07	112.03	924.10	1.82
Interest on bare land value	7077.63	7077.63	14155.26	28.45	7077.63	8561.64	15639.27	30.83
Investment current year interest	1369.28	194.40	1563.68	3.14	1353.45	186.72	1540.17	3.04
Investment compound interest	0.00	1832.70	1832.70	3.68	0.00	1815.60	1815.60	3.58
Fixed costs	***9268.48***	***9221.37***	***18489.85***	***37.16***	***9243.14***	***10676.01***	***19919.15***	***39.27***
Total facility costs	***36654.11***	***13109.27***	***49763.38***	***100.00***	***36312.09***	***14410.48***	***50722.56***	***100.00***
Ratio (%)	***73.66***	***26.34***	***100.00***		***71.59***	***28.41***	***100.00***	

Similarly in previous studies, Özalp and Yılmaz (2010) found out that 49.51% of total facility costs occurred in the first year in pomegranate production. Kanat et al. (2017) found out that 65.14% and 72.74% of total facility costs occurred in the first year in semi-dwarf and dwarf apple productions, respectively.

5.2. Production costs

The total production cost items of pear production are given in Table 2. The total production costs were found as 24916.67 $ ha^{-1} in the enterprises which applied good agricultural practices. It was determined that 56.32% of total production costs were variable costs and 43.68% were fixed costs. Bare land value interest was determined to be the most significant cost item of the production costs with the ratio of 28.41%. The ratios of human labor, pesticides and fertilizer costs in total production costs were found as 13.02%, 11.42% and 10.25%, respectively. Besides, 9.16%, 3.83%, 2.05%, 1.53% and 1.37% of the total production costs consisted of netting, maintenance and repair expenses, crop insurance, water and electricity and machinery costs. Certification fee and analysis fee were accepted as cost items in the enterprises which applied good agricultural practices and 0.62% and 0.39% of the total production costs were certification and analysis fees.

The total variable costs and fixed costs were found as 15780.92 $ ha^{-1} and 10977.24 $ ha^{-1} in the enterprises which did not apply good agricultural practices, respectively and total production costs were found as 26758.16 $ ha^{-1}. The ratios of the variable costs and fixed costs in total production costs were calculated as 58.98% and 41.02%. Approximately, quarter of the total production costs were bare land value interest (26.45%) and human labor costs (26.88%). The ratios of pesticides, netting and fertilizer costs in total production costs were determined as 9.50%, 8.53% and 4.93%, respectively. Furthermore, 2.03%, 1.94%, 1.42% and 0.94% of the total production costs consisted of maintenance and repair expenses, crop insurance, water and electricity and machinery costs.

In previous studies conducted to determine the economic analysis in fruit production, Kanat et al. (2017) found out that the ratios of variable costs in semi-dwarf and dwarf apple productions were 64.26% and 65.37%, respectively. Yılmaz et al. (2017) found out that the ratios of variable costs in lemon production by applying and not applying good agricultural practices were 61.24% and 60.07%, respectively. In the same study, the ratios of the variable costs in mandarin production by applying and not applying good agricultural practices were

calculated as 61.13% and 60.41%, respectively. In the study conducted by Aydın et al. (2017), the ratios of the variable costs were calculated as 55.82% and 60.62% in pear production by applying and not applying good agricultural practices.

The bare land value interest was determined to be a significant cost item in two production types. The other significant cost items were facility costs depreciation and garden foundation interest. The ratios of facility costs depreciation were determined as 7.99% and 7.58% whereas the ratios of garden foundation interest were found as 4.99% and 4.74% in the enterprises which applied and did not apply good agricultural practices, respectively. Similarly in previous studies, Özalp and Yılmaz (2010), Aydın et al. (2017), Kanat et al. (2017) and Yılmaz et al. (2017) determined that the interest on bare land value had the highest ratio in fixed cost items.

Table 2: Dwarf pear production costs ($ ha^{-1})

Cost item	GAP		Non GAP	
	Cost	%	Cost	%
Human labor	3243.38	13.02	7191.51	26.88
Machinery	342.47	1.37	251.14	0.94
Fertilizer	2553.29	10.25	1318.40	4.93
Pesticides	2846.67	11.42	2541.32	9.50
Water and electricity	380.73	1.53	380.73	1.42
Netting	2283.11	9.16	2283.11	8.53
Maintenance and repair expenses	955.02	3.83	542.92	2.03
Certification fee	154.61	0.62	0.00	0.00
Analysis fee	96.89	0.39	0.00	0.00
Crop insurance	509.63	2.05	520.32	1.94
Revolving interest	668.29	2.68	751.47	2.81
Variable costs	***14034.09***	***56.32***	***15780.92***	***58.98***
General administration expenses	421.02	1.69	473.43	1.77
Interest on bare land value	7077.63	28.41	7077.63	26.45
Irrigation machine-tool depreciation	101.83	0.41	85.84	0.32
Irrigation machine-tool interest	47.49	0.19	43.38	0.16
Facility costs depreciation	1990.54	7.99	2028.90	7.58
Garden foundation interest	1243.41	4.99	1268.06	4.74
Fixed costs	***10881.92***	***43.67***	***10977.24***	***41.02***
Total production costs	***24916.01***	***100.00***	***26758.16***	***100.00***

5.3. Profitability and productivity analysis

The economic analysis results in dwarf pear production are given in Table 3. The average yield per hectare was found as 50000 kg in the enterprises which applied good agricultural practices whereas it was determined as 54000 kg in the enterprises which did not apply good agricultural practices. The average pear selling prices were determined as 0.56 $ kg^{-1} and 0.53 $ kg^{-1} in the enterprises, respectively. Gross production values were calculated

as 28000 $ ha^{-1} and 28620 $ ha^{-1} in the enterprises which applied and did not apply good agricultural practices, respectively. Good agriculture practices subsidies were added to gross production value of pear production by good agricultural practices and this value was calculated as 28114.16 $ ha^{-1}.

Production costs per kilogram was calculated by dividing total production costs to the production amount and they were found as 0.50 $ kg^{-1} in the enterprises which did not apply good agricultural practices. Gross profit indicated the difference between the gross production value and the variable costs and they were calculated as 14080.07 $ ha^{-1} and 12839.08 $ ha^{-1} and net profit indicated the difference between the gross production value and the total production costs and they were calculated as 3197.49 ha^{-1} and 1861.84 $ ha^{-1} in the enterprises which applied and did not apply good agricultural practices, respectively. Both of the profitability indicators revealed that dwarf pear farming by good agricultural practices increased the profitability level.

Breakeven point analysis indicated the production level of return to profitability. Pear production amounts on breakeven point per unit were calculated as 38864 kg and 45738.5 kg in the enterprises which applied and did not apply good agricultural practices, respectively under the existing cost and price conditions. In other words, approximately more than 39 and 46 tons of pear should be produced in the enterprises which applied and did not apply good agricultural practices, respectively in order to obtain profit (net profit). These results indicated that the production costs per unit area were higher in pear production by not applying good agricultural practices and this caused required pear production amount to be higher for return to profitability.

Table 3: Yield, production value, cost and profitability indicators in dwarf pear production

	GAP	Non GAP
Yield per hectare (kg ha^{-1})	50000.00	54000
Production cost per kilogram ($ kg^{-1})	0.50	0.50
Sale price per kilogram ($ kg^{-1})	0.56	0.53
Gross output value per hectare ($ ha^{-1})	28000.00	28620.00
Subsidy per hectare ($ ha^{-1})	114.16	0.00
Gross production value + Subsidy ($ ha^{-1})	28114.16	28620.00
Gross profit per hectare ($ ha^{-1})	14080.07	12839.08
Net profit per hectare ($ ha^{-1})	3197.49	1861.84
Breakeven point (kg ha^{-1})	38864.00	45738.50

Labor, capital and total factor productivities were determined within the productivity analysis (Table 4). Gross and net labor productivity values indicated the gross production

value and net profit value in return of 1 $ labor cost, respectively. Gross labor productivity and net labor productivity of pear production were determined as 8.67 $ and 0.99 $ in the enterprises which applied good agricultural practices whereas they were calculated as 3.98 $ and 0.26 $ in the enterprises which did not apply good agricultural practices. Both of the indicators indicated that the labor productivity was higher in pear production by applying good agricultural practices although more labor per unit area was used.

Another factor productivity indicator was capital productivity. Facility costs were taken as capital in the enterprises. Gross and net capital productivity values indicated the production value and net profit value in return of 1 $ pear orchard investment, respectively. Gross and net capital productivities were found as 0.57 $ and 0.06 $ in pear production by applying good agricultural practices and 0.56 and 0.04 $ in pear production by not applying good agricultural practices, respectively. These values indicated that 0.57 $ of gross production value and 0.06 $ of net profit in return of 1 $ pear facility cost were obtained in the enterprises which applied good agricultural practices whereas it was determined that 0.56 $ of gross production value and 0.04 $ of net profit in return of 1 $ pear facility cost were obtained in the enterprises which did not apply good agricultural practices. These values indicated that the capital productivity was higher in dwarf pear production by applying good agricultural practices.

The other productivity indicator was total factor productivity. Gross and net factor productivity values indicated the production value and net profit value in return of 1 $ expense. Average of 1.13 $ and 1.07 $ production values were obtained in the enterprises which applied and did not apply good agricultural practices, respectively. In other words, 0.13 $ and 0.07 $ net profits in return of 1 $ expense were obtained in the enterprises which applied and did not apply good agricultural practices, respectively. These values indicated that rate of return of the expenses were 13% and 7%, respectively. Total factor productivity values indicated that the productivity level was higher in dwarf pear production by applying good agricultural practices.

In previous studies conducted to determine the economic analysis in apple production, Aydoğmuş and Yılmaz (2010) and Kanat et al. (2017) determined that apple production using dwarf rootstock had the highest gross factor productivity. In previous studies conducted to determine the economic analysis in pear production regarding good agricultural practices, Aydın et al. (2017) determined that the gross factor productivity of pear production by good agricultural practices was higher.

Table 4: Productivity indicators in dwarf pear production ($)

	GAP	Non GAP
Gross labor productivity	8.67	3.98
Net labor productivity	0.99	0.26
Gross capital productivity	0.57	0.56
Net capital productivity	0.06	0.04
Gross factor productivity	1.13	1.07
Net factor productivity	0.13	0.07

6. Conclusion

Conceptual and practical studies within good agricultural practices are limited in Turkey. This system doesn't have premium price but provides higher price according to the other crops and buying guarantee to the producer in the purchase which is especially done for exportation and is not still accepted between the producers. As it is a certified system, it composes a significant additional cost for the producer. The acceptance of this system becomes difficult in terms of the producers as there are too many registrations to be recorded and the preparations of production areas and infrastructure of the enterprise are inconvenient.

It can be stated that the traditional agriculture systems do not have future within the scope of international agreements. The latest production and marketing systems become important gradually in terms of product differentiation in foreign markets. The sustainable systems in the agriculture appear by renewing in different types. Nevertheless, no conventional market exists for these kinds of systems in domestic market.

Development of the markets, the conscious which rises as a result of the demands of the customers and the subsidies will contribute to the expansion of good agricultural practices and these kinds of systems.

Although the farmers applying good agricultural practices in dwarf pear production obtained relatively less yield, it was observed that they conducted a more profitable production according to the farmers not applying good agricultural practices due to the less amounts and prices of the pesticide, fertilizer and irrigation water applications.

First of all, the marketing of crops produced by good agricultural practices should be advantageous and the subsidies for good agricultural practices should be increased for the popularization of good agricultural practices. Besides, technical trainings should be provided to the farmers and advertisements concerning good agricultural practices for the consumers should be done. Furthermore, regulations should be done on the instructions about good

agricultural practices and the controls should be increased.

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