Investigation of Factors Affecting Pistachio Orchards' Productivity in Kerman Province

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A R T I C L E I N F O	A B S T R A C T

Investigation of factors affecting total and partial productivity with applying these factors for reforming producers' economical/ technical management may provide a proper base for enhancing productivity and profitability as well, and then leading a more sustainable situation for Pistachio orchards in the future. In this paper with respect to scattering type of statistical population, a multi stage cluster random sampling method applied for data collection. The 200 producers selected based on area planted in each region and interviewed personally, with completing a research questionnaire, during 2012-2015. Turnquist- till index, multi-variable regression and analysis of variances applied to investigate orchards productivity and factors affected. Results indicated that average productivity, maximum productivity and productivity growth rate had declined during study period. Results also indicated that producers' education level and chemical fertilizers amount had positive effect on total productivity, but number of garden fractions, number of family members, ratio of the number of male to female tress and amount of organic manures had negative effect on total productivity. Results also revealed that partial productivity of Labour force, fluid fertilizers, organic manures and water resources had positive effects on production per hectare. Finally, to enhance productivity and profitability of farming system and reach to a more sustainable one, it is suggested to provide necessary circumstances for entrance of agricultural graduated people in pistachio production sector, to program an integrate pistachio farms system and to put more effective supervision/monitoring on agricultural inputs and credits market.

Introduction

The pistachio crop has grown in about 15 per cent of the cultivated area in the country under the cultivation of 359078 bearing hectares and 98258 non-bearing hectares over the total cultivated area of 457337 hectares in 2016. Kerman Province, with a cultivated area of 203050 bearing hectares and 9000 non-bearing hectares with the total cultivated area of 212050 hectares, has got about 46 % of total pistachio orchards of the country (Ministry of Jihad-Agriculture, 2016). Regarding the amount of pistachio production, there are several reports in different statistical sources for different years. According to statistics released by the Ministry of Jihad-Agriculture (2016), the country's pistachio production has been

reported to 261101 and 304420 tones for 2015 and 2016, and Kerman province has been producing 96328 and 112083 tons of pistachio in the same period. The average yield of pistachio for the entire country in 2015 and 2016 were 778 and 848 kg per hectares respectively and for Kerman province has been 477 and 552 kg per hectares, respectively in the same years. As statistics show, the productivity of pistachio production in the country, and especially in Kerman Province, has been significantly reduced recently .Compared to increasing trend of the production costs and the price received by the producers, the production profitability is not satisfactory. So the continuation of such production process will lead a non- profitable situation.

Past studies on the production and export of pistachio crop have emphasized over the reduction of productivity (yield per hectares), incensement of production costs and reduction of crop profitability in recent years (Sedaghat, 2002; Sedaghat, 2008 and Sedaghat, 2009). The decreasing trend of produce per hectare, under high inflation in the country which leaded to an increasing trend for the cost of Pistachio crop, may be a serious risk for the country's pistachio industry. Past studies by the author also showed a kind of economic vicious cycle in production and farmers income, which entails unsustainable pistachio production in the country. (Sedaghat, 2006. Sedaghat, 2008. Sedaghat, 2008, Sedaghat 2011 and 2018b). The policy making over the reduction of production costs and enhancement of producers received price should be managed at a macro level by the government, and it is not something that farmers alone can play an important role; therefore, the only way which producers / exporters can pursue their position in coming years is to increase production/ export productivity, which again need government supports. according to the importance of pistachio crop in terms of income generation and employment for the country's economy, especially in Kerman province and in order to preserve / promote the relative advantage of production and export, as well as the

country's position in the world market, the promotion of production productivity, increasing the quantity and improving the quality and enhancing export of product are crucial. In this research, factors affecting productivity of Pistachio crop were investigated over the study period in Kerman province and some applicable suggestion made toward a better situation in years to come. The related literatures are as follows:

Rosegrent and Evenson (1993) conducted a study regarding the growth of agricultural productivity in Pakistan and India. The study was conducted in 13 Indian states and 3 Pakistanian states. Required data were collected during the 1955 - 85. In this study, total productivity index of Turnquist-till was calculated. Results showed a positive growth of agricultural productivity in both countries and it was due to suitable efficiency of research and extension in both countries. Islam (2000) examined the growth of agricultural productivity in Western Australia between 1978 and 1998 using the Turnquist index. He also compared the calculated efficiency for the West Australia with the rest of the country. He resulted that the average productivity growth rate for Western Australia was 4.2 %, which had higher growth rates compared to other Australian areas.

Sedaghat (2002) conducted a research entitled "the study of the economic theory around the continuum of poverty and un-developed in the pistachio regions of Iran". In this study, two – stage random sampling method has been used. The data collected from 120 Pistachio producers in Rafsanjan city in 2000 - 2001. The results showed that because of farm small scales and high production costs, the pistachio production trend will lead to non - economic situation and lower income and employment levels are inevitable.

Akbari and Ranjkesh (2003) conducted a research entitled "the study of productivity growth in the agricultural sector in Iran". In order to perform this study, time series statistics were used. The information was collected in 1966 - 1996. The results showed that in the agricultural sector productivity is

increasing and indicates that the country's economic growth is effective in the agricultural sector. Rafiei and Zibaei (2003) conducted a study on the size of the state, economic growth and labor productivity in the agricultural sector. They used the models suggested by lee- leen and Goose -Noorzad studies. The results of the study showed that the size of the state has a positive and significant role on the growth of agricultural sector and labor productivity in the agricultural sector has a direct relationship with the investment of the public sector.

Mojaverian (2003) conducted a survey to calculate for Malemquist productivity index for strategic products in 1989 - 1999. The results of the study showed that efficiency in water used production (excluding barley) has increased and for all produces with productivity improvement, technology has improved. Karbasi and Nodehi (2004) carried out a research on productivity of wheat production factors in khorasan. In this study, cross - sectional data were used and final productivity of wheat producers was calculated and analyzed in small and large farms. The results showed that the producers use labor and chemical manure more than optimal level and marginal productivity of chemical pesticides, machinery and land is higher in smaller farms. Alvanchi and Saboohi (2007) carried out a study on productivity growth in Iranian wheat production. In this study Turnquist index was used during 1981 - 2005 years. The results showed that the growth of productivity was negative, which indicates a higher growth of inputs than the yield. Results indicated that instead of consuming more inputs, it is necessary to emphasize on proper composition and optimum use of inputs.

Tahamipoor *et al*. (2007) conducted a study to compare the total productivity growth of the Iranian economic sectors. In this study, Solo model was used during 1991 - 2003. The results showed that the average total productivity growth rate for agricultural sector is more than communications, water, and higher power sectors but less than other sectors.

Results also indicated that the average growth rate of total productivity in agricultural sector was higher than the average growth rate of total productivity of the whole country's economy. Tahamipoor and Shahmoradi (2007) conducted a study on measuring total productivity growth of the agricultural sector and its contribution to the growth of the added value. To do this research, Solo stayed index and the added value variables were used. The results showed that the share of productivity growth from value - added growth is negative. Mazhari and Mohadeshossaini (2007) conducted a study on measurement and comparison of total productivity for the strategic products of agricultural sector in razavi khorasan province. In order to perform this research, the Turnquist- Till index was used. The necessary information was collected during the period of the five - year programmed on wheat, barley and blue cotton and sugar beet. The results indicate an increase in total productivity index.

Khayati and Mashoufi (2007) conducted a study entitled Total productivity estimation and analysis of fish farms. Information was collected using 236 samples by a survey research. The results showed that there is a significant difference between total productivity in different fish farming systems.Amirtaimoori and Khalilian (2007 carried a research on total productivity growth rate in the country's agricultural sector in the fourth plan of development. The results of this study showed that the total productivity growth of the agricultural sector was 2.5 percent at mean. This indicates the proper growth of productivity and good performance of the agricultural sector in the optimal use of production resources. Rafiei and Amirnejad (2008) carried out a study entitled" the productivity of production factors and the effectiveness of its component in dried wheat. In order to do this research, data envelopment analysis method and Malemquist index were used. The results showed that the provinces of mazandaran, kurdistan, Fars, semnan, and east azerbaijan had a good growth, results also showed a significant correlation between

total productivity changes and technology but no meaningful correlation between total productivity and efficiency.Sadatmoazeni and Karbasi (2008) conducted a study on measurement of efficiency using pervasive data analysis method. For this purpose, two - step cluster sampling method was used. The information gathered from Pistachio producers in Zarand city in 2005 - 2004. The results showed that the average technical efficiency Zarand and Ciriz plains were 52 % and 62 %, respectively.

Tripati (2008) conducted a survey as the total productivity growth in Indian agriculture. Results showed that during a period of 37 years (2005 - 2005) the growth of agricultural sector was coupled with the growth of production inputs, while the productivity growth has been negative. He considered that the main factor entailed the negative growth of productivity was low investment from government in Indian agricultural sector.Amirtaimoori and Chizari (2008) conducted a study on dynamic self-sufficiency of seed corn production in Iran using Turnquist-Till index. Data were collected during 2000 - 2004 in Fars, Khoozestan and kermanshah provinces. The most important result was that the total productivity growth experienced an incremental trend, but it was less than one in whole period, except in 2002.

Sedaghat (2009) conducted a study on economic investigation of investment in production and processing of pistachio. For this purpose, a multi - stage random sampling method was used and discounting methodology and even analysis were used to analyze the data. The data gathered from 200 pistachio producer and 10 pistachio exporters in Kerman province and Tehran in 2003 - 2004 years. The results showed that the production of pistachio tradable varieties are profitable in the short - run but are not profitable in the long run. Pistachio processing is profitable both in the short and long term.

Karbasi and Khanjari sadati (2009) conducted a study entitled "the role of information and communications technology on agricultural productivity". In order to perform this study, time series data were used. The information was collected during the 2000 - 2007. The results showed that information and communications technology had a significant positive effect on the overall agricultural productivity of developing countries.

Mafi *et al*. (2009) conducted a study on total productivity for sub- sectors of Iranian agricultural sector. In order to do this research, the Malemquist index has been used. The necessary information was collected during the 1966 – 2006. The results showed that the average productivity growth decreased for fishing, farming and gardening, but increased for and forestry and animal husbandry sub-sectors. The results also showed that the ratio of capital to labor force on total efficiency and rainfall on productivity was effective under the cultivation sector. Mehrabi Bosharabadi and Rashidi Sharifabadi (2009) conducted a study to investigate the relationship between the growth of productivity components and farm size. For this purpose, two - step cluster sampling method was used. Needed information was collected from 298 farmaers in Anar, Rafsanjan, Noogh and Koshkooye districts. Results showed that there is a significant difference between the productivity of small and medium gardens as well as small and large gardens but there is no significant difference between the productivity of the medium and large gardens.Dehghani Filabadi (2009) studied the total productivity changes of major agricultural products in the Chharmehal and Bakhtiari province. In order to do this research, the Malemquist index method was used under data envelopment analysis was used. Data was collected on wheat, barley, potatoes, beans and beets from 2000 to 2007. Results showed that during the period, the impact of total productivity changes in the agricultural sector of the province is more affected by technological change.

Rashidi Sharifabadi and Mehrabi Bosharabadi (2009) investigated the relationship between total productivity and its components with the plants density and variety. Data gathered from 298 pistachio producers during 2005 - 2008 and analyzed using the

analysis of variances methodology. Results indicated that there was a significant difference between the variety of Akbari with varieties of Kaleghoochi, Fendoghi and Ahmadaghaei which have no significant differences.Amirtaimoori and Khalilian (2010) conducted a study on the growth of total productivity in important sectors of the Iranian economy during the first, second and third national programs. Using the Malemquist productivity index, the productivity growth trend in the three important sectors of the Iranian economy (industry and mining, agriculture and transportation) was studied. Results revealed that the productivity growth in agricultural sector was positive due to the change of technology, but negative in the transportation sector. Both factors of technical efficiency and technological change have led to the positive improvement of total productivity and productivity growth in industry sector. Bakhshoodeh and Shekoohi (2011) conducted a research on measuring the scale and how agricultural products contributed to agricultural productivity. The total productivity index calculated for different provinces of khorasan, Fars, Khoozestan and the whole country as well. It examines how each of the agricultural products affects the growth of the total productivity of the provinces. The results showed that the productivity changes in mentioned provinces have been able to affect the country's level of productivity change. Wheat made a main contribution to the growth of agricultural productivity.

Mehrabi Bosharabadi and Javdan (2011) conducted a research to investigate the impact of research on productivity growth and development in the agricultural sector in Iran. The aim of this study was to investigate the way to increase productivity and improve the economic growth. The results confirm that both in short and long terms, R & D expenditure has a positive and significant effect on productivity growth in agricultural sector of the country.

Moghadasi and Sherafatmand (2012) have done a research to investigate the impact of subsidies on total productivity of the agricultural sector in Iran. The purpose of this study is to explore how to achieve growth in the agricultural sector and improve the efficiency of this sector. The results showed that the reduction of subsidies leads to a decrease in the positive shocks of productivity. This effect is asymmetric with an inverse direction. Shahbazi *et al.* (2013) conducted a study to explore the effect of state credit on the total productivity of the agricultural sector in Iran. ARDL method has been used to achieve the objects of the study. Results showed that the increase in the agricultural sector's credit, the planning for the use of suitable lands and farmers' familiarity with advanced farming equipment could play an effective role in improving productivity and increasing the added value of the agricultural sector.

Karbasi *et al.* (2013) conducted a survey as estimating the total productivity of production in Iranian agriculture. Results showed that the share of the productivity growth rate the growth rate of 4.3 % in the agricultural sector was only 0.33 %. The study has proposed to increase the productivity in the agricultural sector to ensure the country's economic growth. Ghanbari *et al.* (2014) conducted a research to study factors affecting energy efficiency in the agricultural sector of Iran. The aim of this research is to improve efficiency as a factor for economic growth. The results showed that the average capital per unit of energy, the real price of petroleum and electricity ratio of energy consumption had a positive effect on energy efficiency in short run. Zare mehrjerdi *et al.* (2017) conducted a study on the effect of mechanization in agricultural productivity. They applied Malemquist index to calculate the total productivity and its components during the period 2009 – 2012. The results showed that the mechanization, the credit availability and training facilities had a positive effect on productivity growth.

As seen before, the number of research done on Pistachio productivity aspects were not quite enough to prepare complete response to the needs of Pistachio industry which is facing with lot of obstacles in recent

years. So doing a new research on the topic was found to be very important.

Material and Methods

Models

Turnquist- till index was used to calculate total productivity of production, which is the most complete and the most appropriate index of productivity. This index has many advantages including its application when a return to scale is heterogeneous and variable, which is very common in agriculture (Rosegrent and Evenson, 1992).

The mathematical form of the Turnquist- till index is as follows:

$$\left[\frac{TFP_t}{TFP_0}\right] = \frac{\pi\left[\frac{Q_{it}}{Q_{i0}}\right]^{1/2(R_{i0}+R_{it})}}{\pi\left[\frac{X_{it}}{X_{i0}}\right]^{1/2(S_{i0}+S_{it})}} \qquad (1)$$

In the above model the numerator is output quantity index and the denominator is inputs quantity index. If logarithm was taken from both sides of the model, the following relationship is obtained.

$$In\left[\frac{TFP_t}{TFP_0}\right] = \frac{1}{2}\sum_{j=1}^{n}\left(R_{j0}+R_{jt}\right)In\frac{Q_t}{Q_0} - \frac{1}{2}\sum_{i=1}^{m}(S_{i0}+S_{it})In\frac{X_{it}}{X_{io}} \qquad (2)$$

TFP is the index of total factors productivity

R_{i0} and R_{it}, are the share of product i from the total revenue, in reference and current years, respectively.

S_{i0} and S_{it} are the share of input i from the total cost, in reference and current years, respectively.

Q_{i0} and Q_{it} are the amount of product i in reference and current years, respectively.

X_{i0} and X_{it} are the amount of input i in reference and current years, respectively.

In order to calculate the partial productivity, the amount of total production is divided to the amount of each input used.

$$AP = TP / X \qquad (3)$$

AP is average productivity of each input

TP is total production

X is the amount of each input used

Finally, the effects of individual, socio- economic and technical characteristics of farmers/ farms on total and partial productivity were investigated, using multivariate regression and analysis of variances methodologies. The dependent variables of the study in multivariate regressions (models 4-12) and their name explanations are as below:

TFP is Total Factors Productivity, **CP** is Credit Productivity, **WP** is Water Productivity, **SFP** is Chemical Fertilizers Productivity, **CTP** is Chemical Toxins Productivity, **OMP** is Organic Manures Productivity, **MP** is Machinery Productivity, **LFP** is liquid Fertilizers Productivity and **LP** is Labor Productivity.

The comparison between 2 groups of farmers (group 1 less than mean and group 2 more than mean) based on different indicators done to define the difference between those who are below and above the average level of these indicators. The indicators used in this study are private consultant, age of farmers, education level, experience, area cultivated and number of Orchards fractions, water limitation and produce quality (Tables 2-9).

SPSS Software version 22 was used for the aim of data analysis.

Data and Information

According to the statistical population distribution (including all pistachio produsers in Kerman province), data collected by a survey method in Kerman province (Rafsanjan, Anar, Kerman and Sirjan) over four consecutive years (2012- 2015). Two stage random cluster sampling was used to gather information from 200 selected samples. The data included were mainly related to the amount of inputs used and output generated, the price of inputs and produce, information regarded to individual and professional characteristics of producers/ orchards and some other required data (Sedaghat, 2016 and Sedaghat, 2018a).

Results

Results of estimation of total productivity and its growth for Pistachio are shown in Table 1.

According to the above Table, the average productivity is reduced from 2013 to 2015. The productivity growth in 2013, 2014 and 2015 were +20.3, - 9.6 and -31 percent respectively with compare to reference year 2012. The maximum

productivity of 4.27 in 2013, reduced to 2.96 and 2.23 in 2014 and 2015 respectively. Minimum productivity of 0.15 in 2013 decreased to 0.08 in 2014 and increased to 0.25 in 2015. Information also shows that the number of producers with productivity less than 1 has increased from 2013 to 2015. Average total productivity accounted for the whole study period was 0.89 with an average growth rate of -11.

Table 1. Minimum, Maximum, Average and the growth rate of pistachio productivity, during study period in Kerman province.

Variables	2013	2014	2015	Average
Number of producers	58	80	85	-
Average productivity	1.20	0.90	0.69	0.93
Average productivity growth rate with compare to reference year, 2012(percent)	20.3+	9.6-	31-	11-
Maximum productivity	4.27	2.96	2.23	3.25
Minimum productivity	0.15	0.08	0.25	-
Number of producers with productivity less than 1	33	57	70	-
Number of producers with productivity more than 1	25	23	15	-

Results of estimation for factors affecting total and partial productivity of Pistachio are shown in Table 2.

Table 2. Results of estimation for factors affecting total and partial productivity

Model No	Model Name	Estimated Model	R^2	F	SigF
1	Total Factors Productivity	TFP= -0.760X1 -0.490X2 -0.55X3 -1.15X4 +0.79X5	0.87	5.17	0.045
2	Credit Productivity	LNCP= -0.31 X1 -0.33 LNX2 -0.47 LNX3	0.93	38.64	0.00
3	Water Productivity	WP= -0.21X1 +0.42X2 +0.37X3 -0.26X4 + 0.63X5	0.87	5.17	0.45
4	Chemical Fertilizers Productivity	LNCFP= -0.21 LNX1 +0.42X2	0.49	6.80	0.035
5	Chemical Toxins Productivity	CTP= -0.46X1 +0.25X2 +0.59X3	0.97	14.52	0.00
6	Organic Manures Productivity	OMP= +0.48X1-0.86X2 +0.74X3 +0.51X4	0.92	4.51	0.012
7	Machinery Productivity	MP= +0.50X1 +0.36X2 -0.45X3 +0.65X4 -0.28 X5	0.96	9.06	0.001
8	Liquid Fertilizers Productivity	LNLFP= +0.53X1 +0.64LNX2 +0.95 LNX3	0.84	2.95	0.034
9	Labor Productivity	LP= +0.58X1 -0.75X2 +0.98X3 + 0.55X4 +0.89X5	0.86	2.85	0.04

According to the models estimated in Table 2, each model is explained as follows: In model 1, the total factors productivity is dependent variable and the independent variables are the number of garden fractions, the number of family members, the number of female trees per a male tree, the amount of organic fertilizers and the amount of chemical fertilizers. As observed from the above estimated model, the consumption of chemical fertilizers had a positive

effect on total productivity while other variables had negative effects on total productivity. In model 2, the dependent variable is agricultural credit productivity and the independent variables are soil texture (by moving from light to the heavy soil textures), the amount of organic fertilizers and the amount of chemical fertilizers. All these factors had negative effects on agricultural credit productivity. In model 3, the dependent variable is water productivity and

independent variables are private adviser, credits, consumption of chemical pesticides, and consumption of chemical fertilizers and productivity of chemical pesticides. The private consultant and consumption of chemical fertilizers had negative effects on water productivity, while agricultural credit, chemical pesticides and productivity of chemical pesticides had positive effects on water productivity. In model 4, the dependent variable is the productivity of the chemical fertilizers and the independent variables are the number of family members and soil texture. The number of family members had negative effect on the productivity of chemical fertilizers but the soil texture (by moving from the light to heavy soil texture) had positive effect on the productivity of chemical fertilizers. In model 5, the dependent variable is the productivity of the chemical toxins and the independent variables are agricultural experience, age of trees and water productivity. The age of trees and water productivity had positive effect while farming experience had negative impact on productivity of chemical pesticides. In model 6, the productivity of organic manures is dependent variable and the independent variables are soil texture (by moving from light soil texture to heavy soil texture), credits, and labor force and labor productivity. Soil texture, labor force and labor productivity had positive effects while agricultural credits had negative impact on productivity of organic fertilizers. In model 7, the

dependent variable is productivity of agricultural machinery and independent variables are experience, soil texture (by moving from light soil texture to heavy soil texture), organic fertilizers, water consumption and total productivity. Experience, soil texture and water consumption had positive effects while consumption of organic fertilizers and total productivity had negative effect on productivity of agricultural machinery. In model 8, the dependent variable is productivity of liquid fertilizers and independent variables are private adviser, age of trees and labor. All the variables had positive effects on productivity of liquid fertilizers. In model 9, the dependent variable is productivity of labor and the independent variables are number of garden fractions, soil texture (by moving from light to heavy soil texture), credits, liquid fertilizers and productivity of organic fertilizers. Soil texture had negative effect but other variables had positive effects on labor productivity.

Results of investigating factors affected partial productivity of other agricultural inputs revealed that, there was no significant relationship for them.

The results of the estimating of effective factors on total productivity and partial productivity using analysis of variances shown in Tables 3 to 10. The comparison mean based on having private consultant shown in Table 3.

Table 3. The comparison mean based on having private consultant in study area.

Significant variable	Mean for group 1 (without consultant)	Mean for group 2 (with consultant)	F Statistics	Sig
Productivity of Chemical fertilizers	4.48	8.43	4.85	0.045

On the basis of the above Table, there is a significant difference between those who lack private advisors for their own garden, with those with private advisors, in terms of productivity for chemical

fertilizers. People, who had their own private advisers, had higher chemical fertilizer productivity. The comparison mean based on the age of pistachio beneficiaries indicated in Table 4.

Table 4. The comparison mean based on the age of pistachio beneficiaries in study area.

Significant variable	Mean for group 1 (age less than 52.93)	Mean for group 2 (age more than 52.93)	F Statistics	Sig
Productivity of liquid fertilizers	314.52	173.45	4.33	0.042

According to the above table, there is a significant difference in term of productivity of liquid fertilizers between people whose ages are lower than the mean with those whose ages are higher than it. People who are younger had higher liquid fertilizers productivity. The comparison mean based on the education level of the pistachio beneficiaries brought in Table 5.

Table 5. The comparison mean based on the education level of the pistachio beneficiaries in study area.

Significant variable	Mean for group 1 (education less than 3.33)	Mean for group 2 (education more than 3.33)	F Statistics	Sig.
Total Productivity	0.83	1.01	5.36	0.039

According to the above table, there is a significant difference between people whose literacy is lower than mean and higher than mean. People who are more knowledgeable had higher productivity. The comparison mean based on agricultural experiences of the pistachio beneficiaries shown in Table 6.

Table 6. The comparison mean based on agricultural experiences of the pistachio beneficiaries in study area.

Significant variable	Mean for group 1 (experiences less than 30.83)	Mean for group 2 (experiences more than 30.83)	F Statistics	Sig.
Liquid fertilizers productivity	371.33	159.69	4.75	0.033
Chemical fertilizers productivity	6.72	2.88	6.48	0.022

According to the above table, there is a significant difference between people whose experience is lower and higher than the average. People who have less agricultural experience had higher productivity of both liquid and chemical fertilizers. The comparison mean based on the area of pistachio cultivation indicated in Table 7.

Table 7. The comparison mean based on the area of pistachio cultivation in study area.

Significant variable	Mean for group 1 (cultivation area less than 8.79)	Mean for group 2 (cultivation area more than 8.79)	F Statistics	Sig.
Agricultural credits productivity	0.0003	0.001	10.32	0.002
Water productivity	25.57	88.18	7.64	0.01

According to the above table, there is a significant difference in terms of credits and water productivity. People with higher cultivation area had higher credits and water productivity. The comparison mean based on the number of orchards fractions brought in Table 8.

Table 8. The comparison mean based on the number of orchards fractions in study area.

Significant variable	Mean for group 1 (number of orchards fractions less than 4)	Mean for group 2 (number of orchards fractions more than 4)	F Statistics	Sig.
Total productivity	0.99	0.76	4.89	0.029
Labor productivity	18.37	36.17	4.95	0.038
Machinery productivity	42,21	144.91	5.32	0.024
Organic fertilizers productivity	58.63	123.38	4.09	0.046
Water productivity	19.66	78.53	5.73	0.025

According to the above table, there is a significant difference in terms of total, labor, agricultural machinery, organic fertilizers and water productivity. People with fewer orchards fractions had higher total productivity but less labor, agricultural machinery, organic fertilizers and water productivity. The comparison mean based on water limitations shown in Table 9.

Table 9. The comparison mean based on water limitations in study area.

Significant variable	Mean for group 1 (no water limitation)	Mean for group 2 (with water limitation)	F Statistics	Sig.
Agricultural credits productivity	0.0008	0.0003	4.10	0.045
Chemical fertilizers productivity	6.56	3.16	5.53	0.032

According to the above table, there is a significant difference between those who had the limitations of agricultural water, in terms of credits and chemical fertilizers productivity. People had no water restrictions had higher productivity of credits and chemical fertilizers. The comparison mean based on product quality indicated in Table 10.

Table 10. The comparison mean based on product quality in study area.

variable	Mean for group 1 (product quality index less than 0.35)	Mean for group 2 (product quality index more than 0.35)	F Statistics	Sig
Machinery productivity	41.54	122.59	4.65	0.039
Organic fertilizers productivity	54.78	117.20	4.08	0.046
Chemical toxins productivity	68.98	266.90	5.14	0.027

According to the above table, there is a significant difference in terms of agricultural machinery, organic fertilizers and chemical fertilizers productivity. People, who produced Pistachio with more quality, had higher productivity of machinery, organic fertilizers and chemical fertilizers.

the mean comparison is also carried out based on the number of female trees per a male tree, the age of trees, the number of households, soil texture and water salinity. Results indicated that, there is no significant difference between Total and partial productivity of different factors in base of the mentioned criteria.

Results obtained from multivariate regression also revealed that partial productivity of Labor force, fluid fertilizers, organic manures and water resources had positive effects on production per hectare of Pistachio farms in Kerman province.

Discussion and Conclusions

The results extracted from estimating Turnquist-till index and descriptive statistics concluded that average total productivity, productivity growth rate and maximum productivity of pistachio production decreased over the studied years in Kerman province. Under such economic situation the production of pistachio entering to an unsustainable regime, which entails pistachio industry, a crucial disaster in years to come. This results is in agreement with results presented by Sedaghat, 2002. Alvanch and Saboohi, 2007. Dehghanifillabadi, 2009. Shahbazisanginabadi and Abdollahpoor, 2013 and Tripati, 2008, but is in contrast with results of Akbari and Ranjkesh, 2003. Mojaverian, 2003 and Islam, 2000).

The results obtained from multivariate regression, with the objective of finding factors affecting total and partial productivity of pistachio farms in Kerman province concluded as follows:

The amount usage of chemical fertilizers had a positive effect on total productivity, but the number of garden fractions, the number of family members, the number of female trees per a male tree and the amount of organic fertilizers had negative effect on it. The soil texture (by moving from light to heavy soils), the amount of organic fertilizers and chemical fertilizers had a negative effect on agricultural credit productivity. Private consultants and the consumption of chemical fertilizers had a negative impact on water productivity, while agricultural credit, chemical pesticides usage and chemical pesticides productivity had a positive effect on it. The number of family members had a negative effect on productivity of chemical fertilizers, but the soil texture (by moving from light to heavy soil texture) had a positive effect on it. The age of trees and water productivity had a

positive effect, while farming experiences had a negative impact on productivity of chemical pesticides. The soil texture, labor force and labor productivity had a positive effect, while the credits amount had a negative impact on productivity of organic fertilizers. Farming experience, soil texture and water usage had a positive effect, while consumption of organic fertilizers and total productivity had a negative impact on productivity of agricultural machinery. Private consultants, ages of trees and labor had a positive effect on productivity of liquid fertilizers. The soil texture had negative effect but the number of garden parts, loans, liquid fertilizers and the productivity of organic fertilizers had a positive effect on labor productivity.

The results obtained from analysis of variances, with the objective of finding factors affecting total and partial productivity of Pistachio farms in Kerman province concluded as follows:

The people who had private advisers had higher chemical fertilizer productivity. People who are younger had higher productivity of liquid fertilizers. Individuals who are more knowledgeable had higher overall productivity. Less experienced people had higher productivity of liquid and chemical fertilizers. Those with higher cultivation areas had higher productivity for agricultural credit and water. (The results are in agreement with the results achieved by Rafiei *et al*., 2009 & Mehrabibasharabadi and Rashidi sharifabadi, 2009, but not in agreement with results obtained by Karbasi and Nodehi, 2004). Individuals who had fewer garden fragments had higher total productivity but had less productivity for labor, agricultural machinery, organic fertilizers and water. Those without water restrictions had higher productivity of agricultural credit and chemical fertilizers. Farmers with higher quality of produce had higher productivity for agricultural machinery, organic fertilizers and chemical fertilizers.

Productivity of Labor force, fluid fertilizers, organic manures and water resources had positive effects on production per hectare of Pistachio farms in

Kerman province, so to enhance yield of Pistachio growers there should be an emphasis on promoting mentioned factors productivity.

Suggestion for policy making

1. The appropriate context for wider use of independent and fair- minded agricultural consultants with adequate knowledge and experience should be provided to the Pistachio growers.

2. Enough and urgent motivations for entrance of educated young agriculturalist into agricultural business should be provided.

3. The integration of gardens or at least the integration garden management, with the objective of increasing productivity of small scale farms should be placed in the agenda of the managers and planners of the agricultural sector.

4. There should be a systematic supervision and monitoring on input markets specially, fertilizers and toxins, with the aim of providing high - quality inputs to the farmers at the right time with a rational price.

5. It is needed for an urgent supervision and monitoring on agricultural credit system with the objective of appropriate usage of credits in agriculture sector and improving the efficiency of credit market.

6. The government should make an urgent scientific plan, with focus on increasing yield per hectare and decreasing producers' costs of production under a sustainable resources use regime, especially for water resources.

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