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Original article

The Effect of Sample Hazelnut Orchard Practices on Productivity: Trabzon Province, the Case of Arsin District

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Abstract

Hazelnut, occupying an important place in Turkey's economy, is the main source of income for many families of farmers. Hazelnut is grown especially in the Black Sea region. In recent years, it was observed that the average hazelnut yield in Turkey remained below that in other hazelnut producing countries. This research, it was aimed to investigate whether the agricultural practices carried out in the gardens defined as "sample hazelnut gardens" by the Arsin Chamber of Agriculture in Trabzon province have a positive effect on yield and to compare these practices with those of producers growing hazelnuts with traditional methods. In this study, all of seventeen producers who own sample gardens registered in the Chamber of Agriculture were face to face interviewed according to the census method, and surveys were administered. Simple descriptive statistics were used to analyze the data. Correlation analysis was conducted to reveal the relationship between sample hazelnut orchard practices and yield. In the study, a moderate negative relationship was found between the number of ocak and hazelnut yield at the 5% significance level (r = -0.595), and it was determined that hazelnut yield increased as the number of ocak decreased. The study also revealed that the new practices in pruning, fertilization, and weed control methods of the sample hazelnut orchards yields were higher than those in traditional garden practices. It was determined that the average hazelnut yield obtained by producers who practice hazelnut gardens is approximately 2 times higher than those in Trabzon province and Turkey. It was concluded that sample hazelnut garden practices and agricultural extension and applied training studies need to be widespread and supported in order to increase hazelnut yield in this region.

Keywords: Sample hazelnut orchard, yield, correlation, Trabzon, Turkey.

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INTRODUCTION

Hazelnut is a fruit with high economic value that grows in the temperate climate zone. A limited number of countries in the world grow hazelnuts on an international trade scale. The most important producing and exporting countries are Turkey, Italy, the United States of America (USA) and Azerbaijan (Anonymous, 2019). Turkey is the world's largest hazelnut producer, accounting for 71.11% of the world's cultivated areas and 63.5% of production. In hazelnut production, Turkey is followed by Italy (7.86%), Azerbaijan (6.25%) and the USA (6.53%). Other countries have a 15.86% share (FAO, 2023). According to 2021 data, the countries with the highest hazelnut yield per decare are the USA, Greece and China. In the same year, while the world average hazelnut yield was 104 kg/da, Turkey remained below the world average with 92 kg/da. Turkey ranks 4th in terms of hazelnut yield due to reasons such as the fact that its orchards are old and densely planted, and maintenance and cultural procedures cannot be carried out sufficiently and on time (Table 1) (FAO, 2023).

Table 1. Yield change (kg/da) in hazelnut producing countries between 2011-2021

Countries	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
1-USA	303	302	336	269	204	267	179	260	220	265	285
2-Greece	228	254	297	248	229	181	143	193	212	202	248
3-China	200	200	200	199	202	200	200	201	201	201	194
4-Turkey	100	156	129	106	149	59	95	70	105	90	92
5-Romania	73	50	67	47	94	91	62	140	126	223	80
6-Slovenia	146	158	137	96	219	190	92	183	167	300	77
7-World	119	154	137	112	141	80	107	90	112	106	104

Source: FAO, 2023.

According to 2021 data, 1 million 77 thousand tons of hazelnuts were produced in 1 million 39 thousand hectares of land in the world. Although Turkey increases its hazelnut production areas every year (Table 2), its share in the world has been gradually decreasing in recent years (Figure 1) (FAO, 2023).

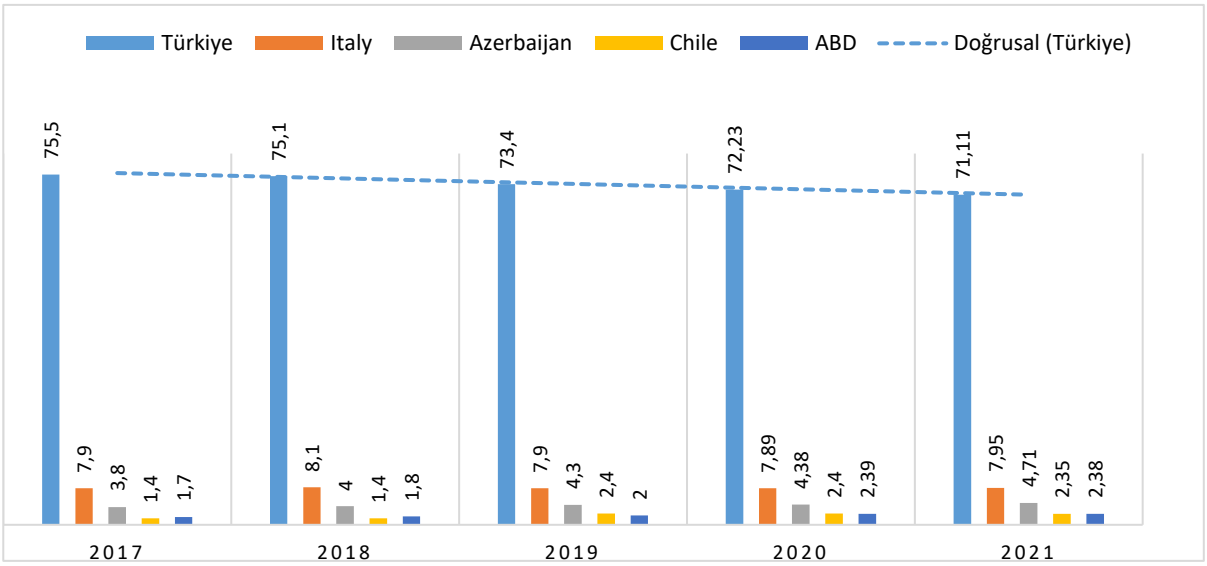

Figure 1. Hazelnut production area distribution (%) in the last 5 years in the main hazelnut producing countries

The reason for this is that the rate of increasing hazelnut production areas of countries such as the USA, Azerbaijan and Chile is above Turkey's.

In Turkey, 759 thousand tons of hazelnuts were produced in 7.36 million decares of land in 2022. Between 2011 and 2022, the average hazelnut yield per decare in Turkey was 83 kg. In Turkey, the hazelnut production area increased by 5.60% from 2011 to 2022, and the amount of hazelnut production increased by 76.51% (Table 2) (TÜİK, 2023).

Table 2. Hazelnut production areas and production amounts in Turkey between 2011-2022

Years	Production area (,000 da)	Production amount (,000 ton)
2011	6.970	430
2012	7.014	660
2013	7.021	549
2014	7.011	412
2015	7.026	646
2016	7.054	420
2017	7.067	675
2018	7.284	515
2019	7.344	776
2020	7.345	665
2021	7.389	684
2022	7.360	759
Total	85.885	7.191

Source: TÜİK, 2023.

Hazelnuts in the temperate rainy climate zone were first produced in the East Black Sea region (Karadeniz et. al., 2009). In the following years, due to the factors such as the state's purchase guarantee and migration, it spread to other coastal regions of the Black Sea region, which has a suitable climate (TMO, 2020). Hazelnuts are grown in almost all provinces bordering the Black Sea, especially Ordu, Giresun and Samsun.

The regions where hazelnut cultivation is carried out in Turkey are divided into three groups 1st, 2nd, and 3rd Standard Regions. The provinces of Trabzon, Ordu, Giresun, Rize, and Artvin are included in the 1st Standard Region, which is considered the most important region (Anonymous, 2020). Hazelnut production in Turkey has been negatively affected due to various factors. Climate conditions, periodicity features, increasing input, and labor costs played a role in this decline. Especially in the 1st Standard Region, which is the ecological region of hazelnuts, the yield is low because the hazelnut orchards are established on infertile lands and are older (Yeni, 2022). According to TÜİK 2021 data, when hazelnut production areas and quantities are examined on a provincial basis in Turkey, Ordu province ranks first. Ordu province is followed by Giresun, Samsun, Sakarya and Trabzon provinces, respectively. While Trabzon province ranks 5th in Turkey in terms of hazelnut production area, it ranks 7th in terms of total hazelnut production amount. It is seen that Zonguldak province ranks first with a yield of 200 kg per decare, followed by Kocaeli, Sakarya, Düzce and Samsun (II. Standard Region provinces) respectively

(Table 3) (TÜİK, 2023). II. The reason why the productivity is higher in the provinces within the Standard Region is that the hazelnut orchards are younger and the number of ocak is less (sparsely planted). Hazelnuts are being grown with the "ocak" system in Turkey. The ocak system is a bush-like and multi-rooted planting system consisting of shoots (İslam et al., 2004; İslam, 2018; Bak & Karadeniz, 2021).

Table 3. Hazelnut production area and production amounts by province in Turkey

Provinces	Production area (,000/da)	Production amount (,000/ton)	Yield (kg/da)
1- Ordu	2272	167	74
2- Giresun	1176	83	71
3- Samsun	1168	117	100
4- Sakarya	795	96	121
5- Trabzon	652	44	68
6- Düzce	632	76	120
7- Zonguldak	265	53	200
8- Kocaeli	83	12	148
9- Kastamonu	78	7	91
10- Bartın	64	6	95
11- Other	204	23	113
12- Total	7389	684	

Source: TÜİK, 2023.

Hazelnut is a basic agricultural product that is a source of income for many producer families in Turkey. At the same time, hazelnut production has been supported for years in order to economically utilize the country's resources, ensure the sustainability of rural life, and ensure income stability for producers who rely solely on hazelnuts for their income (Hazneci et al., 2022). For these reasons, increasing the yield levels obtained from hazelnuts will positively affect producer incomes and contribute more to the regional economy.

Trabzon, the subject of the study, is a city located in the east of the Black Sea with high potential in hazelnut production. However, in Trabzon province, sufficient yield cannot be obtained from hazelnuts due to the reasons such as the age of the hazelnut orchards and the lack of timely maintenance and cultural procedures. The majority of hazelnut producers in the region see hazelnuts only as a source of income during harvest time and do not carry out the necessary maintenance work. Although hazelnut farming is generally carried out in all districts of the province, hazelnut lands and production amounts are in a better position in districts such as Arsin, which have a coast to the Black Sea (Doğanay, 2011).

Although studies have been conducted to date on the effects of various parameters related to yield in hazelnut production (Beyhan et al., 2007; Akçin 2010; Ustaoğlu et al., 2010; Bak 2010; Bozkurt 2010; Çalış 2010; Kırca 2010; Şahin 2010; Özyazıcı et al., 2010). al., 2011; Çalışkan et al., 2019; Özkutlu et al., 2016; Şen 2018; Pekdemir 2019; Ergin 2019; Yaman 2019; Balta et al., 2021; Aydemir et al., 2023) no study was found examining the effect of sample hazelnut orchard practices on yield. This study aimed to determine the current status of the sample hazelnut orchards in Arsin district of Trabzon province in

terms of productivity and cultural practices and to reveal their differences with traditionally produced hazelnut orchards.

MATERIALS and METHODS

The main material of the research was the "sample hazelnut garden" of 17 producers registered with the Chamber of Agriculture in Arsin district of Trabzon province. The gardens in question were established 4 years ago under the supervision of the Chamber of Agriculture.

Arsin district, the study region, is located on the coast, 20 km east of Trabzon province. In the district, which has a temperate and rainy climate, the land structure is slightly sloping. Its total surface area is 158.5 km2. The agricultural production area of the district is 8,407 ha, the forest area is 6,362 ha, the meadow-pasture area is 1034.5 ha, and the area unsuitable for agriculture is 46.5 ha. Within the agricultural production area, the hazelnut production area ranks first with a share of 92% (7,749 ha) (Anonymous, 2023). The location of the research area in the Black Sea Region is shown (Figure 2).

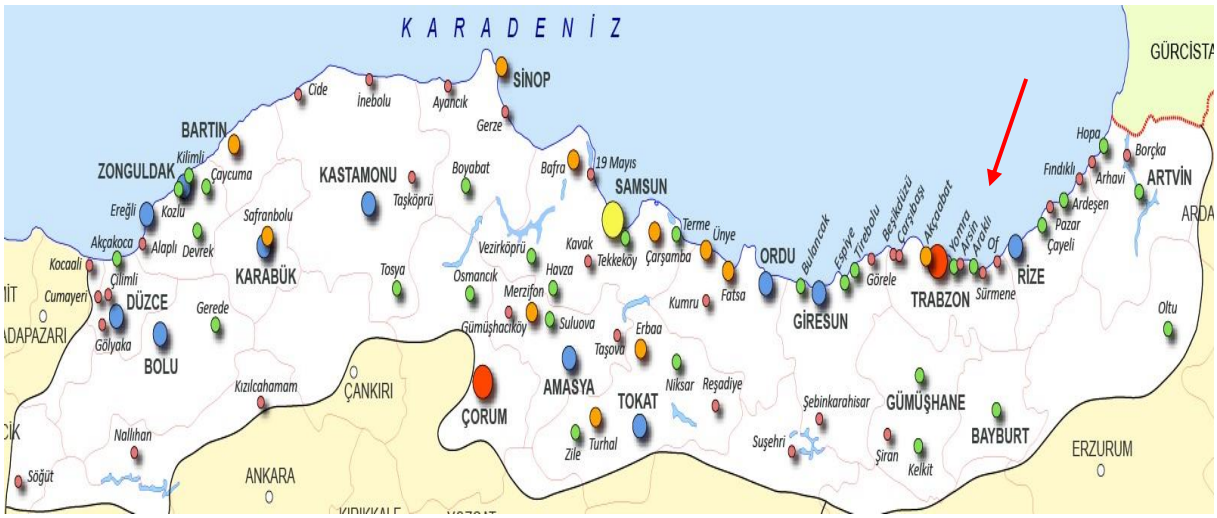

Figure 2. Location of Arsin district, Trabzon province, in the Black Sea Region (Source: Saygılı, 2020).

Survey studies were conducted face to face with all producers according to the full census method in the period of February-March 2023. Questions were asked to 17 producers who own sample hazelnut gardens in the district about their socio-demographic and economic characteristics and the structural and production characteristics of hazelnut gardens (Table 4-5). The data obtained were evaluated using simple descriptive statistics (frequency, ratio and average).

The relationships between sample hazelnut garden practices and yield were determined by correlation analysis. Correlation shows the linear relationship between two or more variables. The correlation coefficient is denoted by “r” and takes values between -1 and +1. If r = -1, there is a completely negative linear relationship, and if r = +1, there is a completely positive linear relationship.

If r = 0, there is no relationship between the two variables (Köklü et al., 2006). Correlation coefficient;

$$r = \frac{N\Sigma xy-(\Sigma x)(\Sigma y)}{\sqrt{[N\Sigma x^2-(\Sigma x)^2][N\Sigma y^2-(\Sigma y)^2]}}$$

N = Number of point pairs

Σxy = Sum of products of paired scores

Σx = Sum of x scores

Σy = Sum of y scores

Σx2 = Sum of squares of x scores

Σy2 = Sum of squares of y scores.

RESULTS and DISCUSSION

In the research, socio-demographic and economic characteristics such as the age of the producers, their educational status, land ownership, social security, non-agricultural income and whether they permanently reside in the village were examined (Table 4). The ages of the producers participating in the survey range between 32-56, with the average age of 46. More than half of the producers are primary or secondary school graduates. Only 29.52% of the producers participating in the research have associate or bachelor's degrees (Table 4).

Table 4. Socio-demographic and economic characteristics of sample hazelnut orchard owners

	Mean / Frequency (N)	Standard Deviation / Percentage (%)
Age (years)	*46*	*9.98*
Educational status		
Primary school	5	29.43
Middle school	4	23.55
High school	3	17.50
Associate degree	2	11.85
Licence	3	17.67
Total	17	100.00
Social security *		
Bağ-Kur	2	11.80
Emekli Sandığı	1	5.90
SGK	14	82.30
Total	17	100.00
Does he always live in the village?		
Yes	3	17.60
No	14	82.40
Total	17	100.00
Non-agricultural income($/month)*	*803.81*	*278.39*

*Bağ-Kur, Emekli Sandığı and SGK are the national health insurance systems implemented in Turkey.

** 1$ =18.88 TL

It was observed that approximately 82% of the social security of the producers is the Social Security Institution (SGK), and the rest is the Tradesmen, Craftsmen and Other Independent Employees Social Insurance Institution (Bağ-Kur) and the Emekli Sandığı. It was determined that 17.60% of the sample hazelnut orchard owners permanently resided in the village, and 82.40% came to the village during harvest time for operations such as fertilization, pruning, and weed cleaning (Table 4). At other times, it was determined that they resided in the district center due to their education and professional status. It has been determined that there is no difference between the cultural practices of producers who permanently reside in the village and those who do not, in the sample hazelnut gardens.

The results showed that the producers who own hazelnut gardens regularly carry out routine maintenance of their hazelnut gardens in line with the recommendations given by the Chamber of Agriculture, but they do not have insurance for their hazelnut gardens. Hazneci et.al. (2022) in their study of hazelnut producers in Giresun province, reported that approximately 66% of the enterprises did not insure their hazelnut orchards. Hazelnut producers who do not prefer to insure their gardens think that it would be more logical to spend the money paid for insurance on hazelnut production. Hazelnut producers participating in the research do not prefer to take out insurance due to the concern that it will increase input costs.

During the interviews, it was reported that producers received direct income support with diesel fuel fertilizer provided by the Ministry of Agriculture and Forestry. It has also been determined that they earn their living from non-agricultural activities as well as the income they earn from hazelnuts. The average monthly non-agricultural income of the sample hazelnut orchard owners was calculated as 803.81 $, and its standard deviation was calculated as 278.39 $ (Table 4). The size of the standard deviation showed that there were significant differences between producer incomes.

Differences Between Sample Gardening Practices and Traditional Methods

Pruning Methods

In Trabzon province, hazelnut orchards are largely old and have completed their economic life, causing a decrease in productivity (Anonymous, 2014). For this reason, in 2018, the "Rehabilitation and Quality Improvement Project of Hazelnut Plantations That Have Completed Their Economic Life" was launched by the Trabzon Provincial Directorate of Agriculture and Forestry in order to renew the hazelnut gardens (Anonymous, 2018). According to the data of Trabzon Provincial Directorate of Agriculture and Forestry; in hazelnut gardens, hazelnuts are produced with traditional cultural practices. However, it has been stated that cultural practices such as pruning, fertilization, disease and weed control in hazelnuts are not carried out adequately and in accordance with the technique (Anonymous, 2014). Incorrect or inadequate pruning makes hazelnut harvesting difficult by requiring more labor (Karagöl, 2021) and negatively affects the yield (Yaman, 2019; Balta et. al, 2021).

(a) **(b)**

Figure 3. A ocak not adequately pruned (a) and a ocak pruned according to sample garden practice (b). (Source: Arsin Chamber of Agriculture Archives)

In the research, it was observed that the producers who own sample hazelnut gardens were regularly informed by the agricultural engineers working in the agricultural chamber about the practices to be carried out in the hazelnut production process. It has been determined that producers perform maintenance and pruning twice a year, both during the year and after harvest. It has been reported that pruning is done by both cutting branches from inside the ocak and pruning within the branch. When the hazelnut branches are pruned so that they do not touch each other, the hazelnut ocak is opened in the form of eaves and the sun rays can easily reach the ocak (Anonymous, 2022). In an example hazelnut garden, a pruning ocak is shown (Figure 3a) and a hazelnut ocak without pruning in traditional production (Figure 3 b). Although multi-branched hazelnut ocak are thought to be more efficient by local producers, this is not the case both in theory and practice. In ocak with too many branches, the inside of the branches cannot benefit from sunlight sufficiently, and since there are too many branches, the branches cannot be fed adequately in terms of nutrients (Karagöl, 2021). This causes the efficiency to decrease. As a matter of fact, by regularly performing cultural practices in hazelnuts, yield fluctuations can be eliminated (Yaman, 2019), and a contribution to the regional and national economy can be made thanks to increases in yield and quality (Karagöl, 2021).

Fertilizing Methods

One of the mistakes made by producers who cultivate hazelnuts using traditional methods is fertilization practices. Local producers engaged in hazelnut production in the research region prefer

unburned (fresh) barn manure instead of burnt manure (Anonymous, 2022). However, in the study titled "Barnyard Manure Preservation and Application" by the Ministry of Agriculture and Forestry, it is stated that care should be taken to ensure that the barnyard manure is not fresh and is burnt. The reason for this is that the possible weed seeds and disease factors in the barn manure lose their properties during burning (TOB, 2017). In the research area, some hazelnut orchards where fertilization was carried out using traditional methods were photographed and the producers were interviewed. It has been determined that in these hazelnut gardens, especially fresh barnyard manure is preferred, and fertilizer is applied directly to the hazelnut root, regardless of the slope of the hazelnut land and the projections of the branches (Figure 4 a) (Anonymous, 2022).

(a) **(b)**

Figure 4. Fertilization application made with traditional methods (a), Fertilization example made by Arsin Chamber of Agriculture in sample hazelnut orchards (b) (Source: Keleş & Hazneci, 2023)

The sample hazelnut orchard producers examined prefer burnt barn manure and fertilize according to a certain method. According to this method, the slope of the gardens is taken into account. The application is made to surround the hazelnut ocak according to the branch projection, not directly to the root of the hazelnut. Fertilization application is done by first hoeing and then mixing the fertilizer into the soil (Figure 4 b). In the sample hazelnut orchards, barn manure, nitrogen fertilizer and agricultural lime applications are made. All of these applications are made according to soil analysis results, and they appear to be similar in terms of application to burnt barn manure (Figure 5). It is recommended to perform soil analyses for fertilization and to make applications considering the results obtained (Özkutlu et al., 2016; İslam, 2018; Karagöl, 2021).

Figure 5. Agricultural lime application in a sample hazelnut garden. (Source: Arsin Chamber of Agriculture Archives)

In soil that contains enough lime, extra lime application without testing will cause more harm than good to the soil. In this case, hazelnut yield will decrease instead of increasing. For this reason, it should not be forgotten that it is necessary to have a soil analysis done before applying lime.

Weed Control Methods

Fern, nettle, wild blackberry and wild wormwood are the most common weeds seen in hazelnut gardens in the region (Anonymous, 2013). Weed density is increasing on the Black Sea coastline due to climate characteristics. Weeds, which multiply rapidly with rainfall and fertilizer applications, share the water and nutrients of the trees in hazelnut orchards, causing a decrease in productivity (Anonymous, 2013). Throughout the region, weeds are mowed once a year before harvest, with traditional methods and practices inherited from family elders (Balta et. al., 2021; Karagöl, 2021). However, until harvest time, weeds damage soil nutrients. In addition, the use of fresh barn manure instead of burnt barn manure causes foreign weed seeds to come into hazelnut orchards (Anonymous, 2022). It is seen that weeds surround all hazelnuts and inside the ocak, and they have reached the highest level of maturity in terms of height (Figure 6 b). It is noteworthy that weeds are quite widespread in terms of both their diversity, frequency and size. However, in the image, the differences in the ocak, pruning frequencies and maintenance practices between the sample hazelnut orchards and the hazelnut orchards cultivated with traditional practices can be seen (Figure 6). In order to combat weeds, sample garden owners pay attention to the seeding time of weeds and mow the weeds before they set seeds. Producers carry out mowing twice a year. In this way, weeds are prevented from reaching maturity and multiplying in hazelnut orchards. It was observed that there was a decrease in the variety of weeds in the sample hazelnut orchards (Figure 6 a).

(a) **(b)**

Figure 6. Weed status of a sample hazelnut garden (a), Weed status of a hazelnut garden cultivated with traditional methods (b). (Source: Keleş & Hazneci, 2023)

Structural and Production Characteristics of Hazelnut Orchards

In the study, the structural and production characteristics of sample hazelnut orchards were investigated; How many years ago did sample gardening practices begin, the number of ocak in the gardens, total land assets, hazelnut grove area, increase in productivity after sample garden practices, total hazelnut production and hazelnut production per decare were examined (Table 5). In the sample hazelnut orchards that were started approximately 4 years ago, the number of ocak varies between 51 and 80. It was determined that the number of ocak per decare was 61-70 in approximately 65% of hazelnut orchards, 71-80 in approximately 29%, and 51-60 in 6%. When the relationship between the number of ocak and hazelnut yield was examined at the 5% significance level, a moderately negative relationship was detected ($r = -0.595$). In this case, it is possible to say that hazelnut yield will increase as the number of ocak decreases, and conversely, as the number of ocak increases, hazelnut yield will decrease (Table 5).

In order to increase the productivity in hazelnut orchards, it is important to remove densely located ocak and regularly prune excess branches. For quality product and maximum efficiency, it is recommended to limit the number of branches in the ocak to 8. It is stated that if this number increases, decreases in quality characteristics may occur (Bak, 2010). It was observed that in the sample hazelnut

orchards, pruning practices were carried out by taking into account the 8-branch ocak system and optimum efficiency was tried to be obtained. When pruning is done with this system, it has been observed that less labor is used and the hazelnut yield increases, since 10-15 branches are not dealt with at harvest time, as in traditional hazelnut production. This finding was made by Çalışkan et. al., (2019), coincides with the results they found.

Table 5. Structural and production characteristics of hazelnut orchards

	Average / Frequency (N)	**Standard Deviation / Percentage (%)**
How many years ago did sample gardening practices begin?	*3.76*	*1.64*
Number of ocak (pcs/da)*		
51-60	1	5.90
61-70	11	64.70
71-80	5	29.40
Total	17	100.00
Land assets (da)	*20.58*	*6.46*
Total hazelnut area (da)	*16*	*5.10*
Hazelnut yield increase per decare after sample garden practices (kg)		
There has been no increase yet	5	29.40
0-50 kg	9	52.90
51-100 kg	3	17.60
Total	17	100.00
Total hazelnut production (tons)	*2.76*	*1.15*
Production amount per decare (yield) (kg)*	*170.5*	*32.5*

*Correlation coefficient between the number of ocak and hazelnut yield at 5% significance level, r = -0.595.

The average land size of the producers who own sample hazelnut gardens was determined to be approximately 21 decares, and the average hazelnut land size was 16 decares. The size of the producers' hazelnut land varies between a minimum of 7 decares and a maximum of 34 decares. The proportion of hazelnut areas in the total land of the producers was found to be 77% (Table 5). This result shows that hazelnuts dominate the total agricultural practices in the region. The remaining approximately 5 decares of land; It is used for shelter and to meet annual fruit and vegetable needs. Some of these lands are forest areas called "oak groves" by the farmers of the region.

Approximately 53% of the producers stated that there was an increase in productivity between 0-50 kg per decare after the sample garden application, 18% stated that there was an increase in productivity between 51-100 kg and 29% stated that there was no increase in productivity yet (Table 5). Although there are many factors affecting productivity, it has been determined that the producers who say there has not been an increase in productivity yet started their sample garden practices 1 or 2 years ago. However, it was determined that the yield in the hazelnut orchards of these producers was between 123-135 kg/da.

The total hazelnut production of the sample hazelnut gardens is 2.76 tons. The lowest hazelnut yield obtained by the producers was calculated as 123 kg/da, the highest yield as 217 kg/da and the average yield as 170.5 kg/da (Table 5). It has been stated by the Chamber of Agriculture of Arsin district that the average hazelnut production in the district is approximately 90 kg/da (Anonymous, 2022). When these values were compared, it was determined that the average production of the sample hazelnut orchards was 80.5 kg/da more than the average of Arsin district. Similarly, Yaman (2019), Balta et. al., (2021) and Karagöl (2021) concluded in their studies that differences in maintenance and cultural practices increase efficiency. It is seen that this result coincides with the answers given by approximately 18% of the producers participating in the survey (51-100 kg/da yield increase) and is higher than the answers given by 53% (0-50 kg/da yield increase).

Conclusion

As a result of the research, it was seen that the sample hazelnut gardens in Arsin district were not newly established gardens. These gardens have received the title of "exemplary hazelnut garden" only due to the differences in their practices. It has been determined that the hazelnut yield obtained from the sample hazelnut gardens is almost two time higher than the average hazelnut yield of Turkey and the average hazelnut yield of Arsin district. It was concluded that the increase in yield was due to pruning, fertilization and weed control practices in the sample hazelnut orchards.

In traditional hazelnut orchards, harvest time is generally waited for maintenance practices. For this reason, the need for labor is greater in applications such as weed control and pruning. However, since soil analyses are not often carried out in gardens where traditional agriculture is carried out, unnecessary and harmful fertilization practices can be applied. These wrong practices lead to a decrease in productivity in hazelnut orchards and increase the workload. As a result of the research, it was also seen that although there is not a big difference between traditional methods and sample methods in terms of new applications and workload for gardens, serious differences may arise in terms of efficiency. It is important that these new practices can be transferred to other hazelnut producers in order to carry out hazelnut production, in which we are the world leader, more effectively. Sample hazelnut garden practices will enable many family businesses that make their living from hazelnuts to increase their income. For this reason, especially in newly established hazelnut gardens, producers should be informed about how to carry out sample hazelnut garden practices in details and comprehensively at every stage, starting from planting. Spreading sample practices in hazelnut production regions, both in newly established hazelnut orchards and in existing hazelnut orchards, will increase the yield levels obtained from hazelnuts. Otherwise, Turkey will continue to remain in the lower ranks in productivity compared to competing world countries. It was concluded that there is a need for agricultural extension and applied training studies on sample hazelnut gardens.

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